

Modern

LOCOMOTIVES

ILLUSTRATED

April-May 2019

£4.60



No. 236

Classes 68 and 88

The UK's Number One Modern Traction Partwork

Modern LOCOMOTIVES ILLUSTRATED

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ISSN: 1756-8188

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Modern Locomotives Illustrated is published on the fourth Thursday of January, March, May, July, September and November.

Subscriptions/Mail Order/Back Issues:

Modern Locomotives Illustrated, Key Publishing Ltd, PO Box 300, Stamford, Lincolnshire, PE9 1NA.

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Printing and Origination:

Modern Locomotives Illustrated is Printed in Great Britain by Warners (Midlands) plc, Bourne and is produced by The Railway Centre.Com, Dawlish, Devon, using Apple-Mac systems and Adobe CC.

Trade distribution:

Seymour Distribution Ltd., 2 Poultry Avenue, London. EC1A 9PP. Tel: +44 (0)20 7429 4000

Published by:

Key Publishing Ltd, PO Box 100, Stamford, Lincolnshire. PE9 1XQ.
www.keypublishing.com

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Above: With the Irish Sea as a backdrop, Class 68s Nos. 68004 Rapid and 68003 Astute 'top and tail' a three vehicle Mk2 set, including a DBSO, at Parton on 12 May 2018, with an early morning Carlisle to Barrow service. **Cameron Walker**

Cover: (main) An impressive view of the Cumbrian Coast line is that of Eskmeals Viaduct, south of Ravenglass. On 13 March 2018, Class 68s Nos. 68018 Vigilant and 68017 Hornet cross the River Esk forming the 14.35 Carlisle to Barrow-in-Furness service. **Cameron Walker**

Cover: (inset) Class 88s Nos. 88005 Minerva and 88002 Prometheus pose at Crewe on 29 August 2018 with a southbound flask train. **Cliff Beeton**

MLI Issue – No. 237 Preserved Diesel Locomotives on sale 23 May 2019

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Preservation of modern traction rolling stock is now big business in the UK, with several hundred main line and shunting locomotives preserved on light railways. *Modern Locomotives Illustrated* No. 237 is devoted to preserved diesel locomotives, listing all preserved examples and their location, including illustrations and life histories of many examples. An issue covering electric locos and MUs will follow soon. ■





Classes 68 and 88

This issue of *Modern Locomotives Illustrated* brings the story of the UK locomotive fleets bang up to date, covering the most modern diesel and bi-mode classes to be introduced.

Through a partnership with Beacon Rail, one of the leading traction and rolling stock finance and lease businesses, Direct Rail Services procured a fleet of 34 'state-of-the-art' diesel-electric locomotives to operate their expanding portfolio of freight and passenger services.

At the time of the order, no UK builder could meet the specification stipulated by DRS and thus the order went to Europe, with long time loco specialist Vossloh picking up the contract. This company had for some time been developing a 'Euro-Light' diesel-electric loco to meet the foreseen requirements of the future market, this was soon adapted into a UK Light design suitable for the very restrictive UK loading gauge.

The fleet were constructed at the Vossloh plant in Valencia, Spain. The same factory, when under Alstom control, that assembled the Class 67s in partnership with General Motors.

While the Class 68s were being constructed, Vossloh sold out to Stadler Rail, one of the most established loco and train builders in Europe, being headquartered in Switzerland. However, the Spanish factory has continued to be the main loco and power pack assembly plant.

While the Class 68 order was being completed, DRS, again in partnership with Beacon Rail, sought to procure a fleet of bi-mode (diesel and electric) locomotives, able to operate long distances from the overhead power supply and last mile or local work using a low-output diesel. For this requirement Stadler developed a dual power version of the Euro Light, classified in the UK as Class 88. A fleet of 10 are now in service.

As this edition of *MLI* was in production came the news that Stadler had been awarded a contract for a minimum of 10 tri-mode locomotives to be classified as 93 for Rail Operations Group, these are again funded by Beacon Rail and the first is due for delivery in late 2020. Further orders of the design are expected.

Colin J. Marsden
Editor

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The Vossloh / Stadler Class 68

Direct Rail Services (DRS) is a freight company formed in 1994 by British Nuclear Fuels to take over BRs operation of nuclear traffic flows. For its first four years, it operated limited trains, mainly those carrying overseas nuclear rods for reprocessing at Sellafield. In 1998 it took over the operation of the domestic flask traffic, including trains serving Heysham, Valley, Bridgwater, Berkeley, Hunterston, Torness, Seaton, Dungeness and Sizewell. Even in these early days the company started to look at general freight operations and in 1997 it provided traction and staff for a short term milk flow from Penrith to London Cricklewood. In 2002 DRS introduced intermodal trains between Grangemouth in Scotland and Daventry in the Midlands, operating for the Malcolm Group with traffic for supermarket chain Asda.

In April 2005 the business was transferred to the remit of the Nuclear Decommissioning Authority; soon after, as part of an expansion policy, it diversified into more rail operations including freight services and the provision of drivers and staff for contract services.

In 2006, DRS commenced the operation of the 'Tesco Express' on behalf of Eddie Stobart haulage and in partnership with Tesco moving containerised perishable goods between Daventry and Mossend, near Glasgow and Inverness. Expansion in 2009 saw the provision of a separate dedicated Inverness service. During 2010-2011, this contract operated by DB Schenker before returning to DRS operation.

In terms of passenger services, in 2007 a joint DRS/Stobart venture saw seven former Virgin Trains Mk3 coaches overhauled, to operate charter services under the Stobart Rail banner, with DRS providing traction and crews, this arrangement folded after a year.

In summer 2009, DRS commenced a contract with National Express East Anglia to provide 'Thunderbird' cover for the Great Eastern mainline services, this was extended to providing diesel locos to pilot electric power over non-electrified routes as far as Great Yarmouth in the summer weeks. Further passenger work came along both in East Anglia, working over the Wherry Line, and between April 2009 and May 2010 in Cumbria, working 'shuttle' services between Maryport and Workington following a road bridge being washed away by floods.

From April 2011 DRS commenced a five year contract to provide traction and crew to the

Northern Belle luxury land cruise train.

The company commenced a trial passenger service from 9 January 2012 for just six weeks working a Nuclear Decommissioning Authority staff train between Carlisle and Sellafield. Although the operation was considered a success, it was not until May 2015 that a regular loco-hauled service commenced, using locos and purchased Mk2 rolling stock. Cumbrian passenger services continued from May 2015 when DRS and Northern initiated a contract to operate services to cover for a shortage of DMUs

Traction

When DRS started business, it operated a small fleet of Class 20s, overhauled for service by Brush Traction, to further its commitments and to cover expansion, more traction was needed, and in 1997 following the abandonment of the EPS Night Star operations, six of the refurbished Class 37/6 locos were purchased. Over the following years, a number of other locos have been obtained, Class 37s of various sub-classes, none of which were in very good condition. During 2001, redundant Class 33s joined the portfolio, but again these were old and not reliable. As part of the DRS traction development policy, especially of running trains 'under the wires', three off lease Porterbrook-owned Class 87s were taken over in 2004 and operated for just six months before being returned to Porterbrook, these three locos now operate as part of the Porterbrook fleet in Bulgaria.

From October 2003, DRS invested in new traction for the first time, with a total of 34 GM Electro Motive Diesel Class 66s being purchased, these were for contract freight work. Later five extra locos were added to the fleet after Fastline Freight ceased train operation. Over the years DRS has divested of many locos, and in 2019, the capital fleet of '66s' stands at 19.

From 2008 DRS started to take-over Class 57s in both the 57/0 (no heat) and 57/3 (ETH fitted) examples, again these were old, having been rebuilt from Class 47s and fitted with secondhand General Motors power units.

In 2012-2013 as part of an expansion programme, DRS set about the procurement of new locomotives, frankly at the time, there was nothing 'off-the-shelf' available, apart from Class 66s, which DRS had already purchased several years before and were now considered as unsuitable for the type of work DRS wished to progress.

Therefore, a trawl of suitable traction

commenced, US-based General Motors was ruled out, General Electric, another US company, only had the Class 70 design suitable for the UK loading gauge, this design was heavy and unsuitable for express running and could not support head end power or electric train supply. Therefore, the choice was very limited and would be between Bombardier, Alstom, Siemens or the relatively new, to the loco construction scene, Vossloh. Bombardier, Alstom and Siemens did not have any locos suitable to meet the UK loading gauge, however, Vossloh did, as they had been developing a new design 'Eurolight' Bo-Bo loco, which could with relative ease, be adapted to the UKs restrictive loading gauge.

Before we look at the 'Eurolight' project, we need to look at Vossloh. Vossloh is a German-based company, founded in 1888, but first produced railway components back in 1883 for the Royal Prussian Railway, from then the company had a presence in rail engineering, mainly building component parts, but did engage in locomotive development and construction.

In 2000 Vossloh and Angel Train formed a partnership called 'Locomotion Partners', this was owned 90% by Angel and 10% by Vossloh and was a loco procurement, lease and management company based in London. Vossloh sold their small share to Locomotion Capital in 2004.

In 2005 Vossloh entered the loco construction business in a big way, when it took over the former Meinfesa (Mediterranea de Industrias del Ferrocarril) plant, which since 1991 had been operated by Alstom and operated from the Albuixech plant in Valencia, Spain. This factory had a huge pedigree in quality locomotive building, including RENFE Classes 310, 311 and 319, plus many export locos including the 30 UK Class 67s for EWS, which were constructed as a joint EMD/Alstom venture.

In 2010 Vossloh built a prototype Eurolight Bo-Bo, No. 92 80 1284 001-5 and presented it at Innotrains, held in Berlin in September of that year. This paved the way for a partnership between DRS and UK leasing company Beacon Rail to develop a UK version of the design in partnership with builders Vossloh. The loco was titled the UK light.

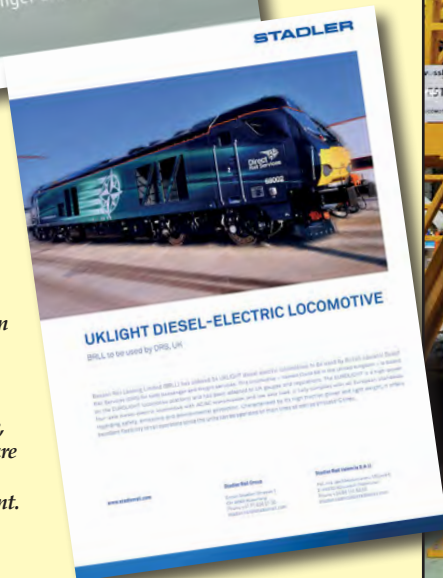
This new design of loco could be built to the UK loading gauge and met the UK crash worthiness levels, as well as the stringent stage 111a emissions targets. The prime mover to be incorporated was a Caterpillar C175 a 16 cylinder machine set to



Left: The Class 68s and 88s were built in the Albuixech, Valencia factory of Vossloh, later Stadler Rail in southern Spain. The original plant previously operated by Alstom and the production facility which built the EWS Class 67s in the late 1990s is a major employer in the area and assembles diesel, electric locomotives, multiple units and trams. On 10 February 2014, the body shell of Class 68 No. 68008 takes shape in the main fabrication shop. Keith Fender



Above and Right: Well before the first loco was built Vossloh produced a brochure for the 'UK Light' design for DRS shown above. On the right is the later Stadler brochure, featuring a picture of No. 68002 at the Valencia plant. CJM-C



Above Right: With its fibre glass front end already applied over the impact resistant steel body structure, Class 68 No. 68007 takes shape in the main erecting shop at Albuixech on 4 March 2014. Just three months after this image was recorded No. 68007 was in the UK. Keith Fender

Below: Much of the equipment installation work for the Class 68 build was undertaken before the bodysides were panelled. In this view, the Caterpillar C175-6 power unit painted in mustard, coupled to the ABB WGX560 generator group at the near end finished in blue are already installed, as is the fuel tank. Keith Fender



Class 68 Fleet List

Number	Name	Construction Site	Works No.	Date delivered	Point of Delivery	Transport Ship	Notes
68001	<i>Evolution</i>	Vossloh Valencia	2679	29/08/14	Liverpool [1]	<i>MV Eendracht</i>	Originally carried works plate 2680 of 2013, later changed for correct plate
68002	<i>Intrepid</i>	Vossloh Valencia	2680	07/10/14	Immingham	<i>MV Clipper Point</i>	
68003	<i>Astute</i>	Vossloh Valencia	2681	18/01/14	Southampton	<i>MV Autostar</i>	
68004	<i>Rapid</i>	Vossloh Valencia	2682	15/04/14	Liverpool	<i>MV Tasman</i>	
68005	<i>Defiant</i>	Vossloh Valencia	2683	15/04/14	Liverpool	<i>MV Tasman</i>	
68006	<i>Daring</i>	Vossloh Valencia	2684	15/04/14	Liverpool	<i>MV Atlantic</i>	Working for ScotRail
68007	<i>Valiant</i>	Vossloh Valencia	2685	10/06/14	Liverpool	<i>MV Atlantic</i>	Working for ScotRail
68008	<i>Avenger</i>	Vossloh Valencia	2686	10/06/14	Liverpool	<i>MV Atlantic</i>	
68009	<i>Titan</i>	Vossloh Valencia	2687	31/07/14	Liverpool	<i>MV Deo Volente</i>	
68010	<i>Oxford Flyer (12/16-)</i>	Vossloh Valencia	2688	31/07/14	Liverpool	<i>MV Deo Volente</i>	Working for Chiltern Rly
68011		Vossloh Valencia	2689	31/07/14	Liverpool	<i>MV Deo Volente</i>	Working for Chiltern Rly
68012		Vossloh Valencia	2690	29/08/14	Liverpool	<i>MV Eendracht</i>	Working for Chiltern Rly
68013		Vossloh Valencia	2691	29/08/14	Liverpool	<i>MV Eendracht</i>	Working for Chiltern Rly
68014		Vossloh Valencia	2692	29/08/14	Liverpool	<i>MV Eendracht</i>	Working for Chiltern Rly
68015		Vossloh Valencia	2693	23/09/14	Southampton	<i>MV Auto Bay</i>	Working for Chiltern Rly
68016	<i>Fearless</i>	Vossloh Valencia	2694	24/10/15	Workington	<i>MV Douwe-S</i>	
68017	<i>Hornet</i>	Vossloh Valencia	2695	24/10/15	Workington	<i>MV Douwe-S</i>	
68018	<i>Vigilant</i>	Vossloh Valencia	2696	15/11/15	Workington	<i>MV Eendracht</i>	
68019	<i>Brutus</i>	Vossloh Valencia	2697	15/11/15	Workington	<i>MV Eendracht</i>	Working for TransPennine
68020	<i>Reliance</i>	Vossloh Valencia	2698	23/03/16	Workington	<i>MV Atlantic</i>	Working for TransPennine
68021	<i>Tireless</i>	Vossloh Valencia	2699	23/03/16	Workington	<i>MV Atlantic</i>	Working for TransPennine
68022	<i>Resolution</i>	Vossloh Valencia	2700	23/03/16	Workington	<i>MV Atlantic</i>	Working for TransPennine
68023	<i>Achilles</i>	Vossloh Valencia	2701	04/04/16	Workington	<i>MV Eendracht</i>	Working for TransPennine
68024	<i>Centaur</i>	Vossloh Valencia	2702	04/04/16	Workington	<i>MV Eendracht</i>	Working for TransPennine
68025	<i>Superb</i>	Vossloh Valencia	2703	04/04/16	Workington	<i>MV Eendracht</i>	Working for TransPennine
68026	<i>Enterprise (02/19-)</i>	Stadler Valencia	2944	30/03/17	Workington	<i>MV Atlantic</i>	Working for TransPennine
68027		Stadler Valencia	2945	30/03/17	Workington	<i>MV Atlantic</i>	Working for TransPennine
68028	<i>Lord President (09-18-)</i>	Stadler Valencia	2946	22/05/17	Workington	<i>MV Eemslift Hendrika</i>	Working for TransPennine
68029		Stadler Valencia	2947	22/05/17	Workington	<i>MV Eemslift Hendrika</i>	Working for TransPennine
68030	<i>Black Douglas (12/18-)</i>	Stadler Valencia	2948	22/05/17	Workington	<i>MV Eemslift Hendrika</i>	Working for TransPennine
68031	<i>Felix (02/19-)</i>	Stadler Valencia	2949	22/05/17	Workington	<i>MV Eemslift Hendrika</i>	Working for TransPennine
68032	<i>Destroyer (02/19-)</i>	Stadler Valencia	2950	20/07/17	Workington	<i>MV Eemslift Ellen</i>	Working for TransPennine
68033		Stadler Valencia	3038	20/07/17	Workington	<i>MV Eemslift Ellen</i>	
68034		Stadler Valencia	3039	20/07/17	Workington	<i>MV Eemslift Ellen</i>	

[1] Delivered via Liverpool, collected and taken by Allelys Heavy Haulage to Berlin, Germany for display at Innotrans 2014, travelled via Immingham and Cuxhaven and then by rail to Berlin Messe, return again via Cuxhaven and Immingham arriving on 7/10/14.

deliver 3,750hp (2,800kW), this was coupled to an ABB asynchronous generator group feeding ABB traction motors. The loco design was based on a full width body profile, with a driving cab at each end. This was a slightly modified version of that installed in the prototype 'Eurolight' and adapted to include installation of UK safety systems such as AWS and TPWS.

The locomotive weighed 85 tonnes, giving an axle load of 21.5 tonnes. A top speed of 100mph (160km/h) was stipulated to enable passenger operation. Head End Power (HEP) or Electric Train Supply (ETS) was also installed.

Negotiations continued through 2011, and a firm order for 15 mixed traffic passenger/freight locos was placed between Beacon Rail and Vossloh on 5 January 2012 valued at around €45 million.

Assembly of the locos took place at the Albuixech factory in Valencia, Spain from autumn 2012, with the first complete loco No. 68001 emerging in autumn 2013. This was transferred, painted in white base livery with Vossloh branding to the Czech Republic and tested alongside the original 'Eurolight' prototype on the Velim test track, where it remained until early summer 2014, before being returned to Valencia for painting and de-snagging

before delivery to the UK.

After arrival in the UK at Liverpool docks on 29 August 2014, it was directly loaded onto a road track and taken to Berlin, Germany where it was displayed at the Innotrans 2014 tradeshow.

The first locomotive to be delivered to DRS in the UK for training and commissioning was No. 68002, arriving on 18 January 2014. The entire batch of 15 locomotives of the original order were delivered by September 2014.

At the same time as the last loco of the original order arrived, a follow-on order for 10 loco Nos. 68016–68025 was placed, again these were funded by Beacon Rail and were delivered between October 2015 and April 2016.

With an upturn in contract work, a further Beacon Rail funded follow-on order was placed on 28 July 2015 for seven locos Nos. 68026 - 68032. By the time this order was placed, Vossloh had been sold to Swiss railway engineering company Stadler, who carried on with the previous Vossloh designs. A minor front end detail difference was incorporated in the Stadler locos, the original Vossloh logo was removed from the front end lower panel. A further follow on order for two locos Nos. 68033 and 68034 followed, these were funded directly by DRS. The entire fleet were delivered to the UK by July 2017.

During the course of the original build, DRS →



Left: Before delivery to the UK, the Class 68s underwent a major test cycle at the works test facility, where both static and dynamic testing was undertaken. In this view dated 10 February 2014, 'UK Light' Class 68 No. 68003 shares the test facility with an Israeli Railways Euro 3000 loco, during early testing before bodywork was complete. As can be seen the front end style is very similar. Keith Fender



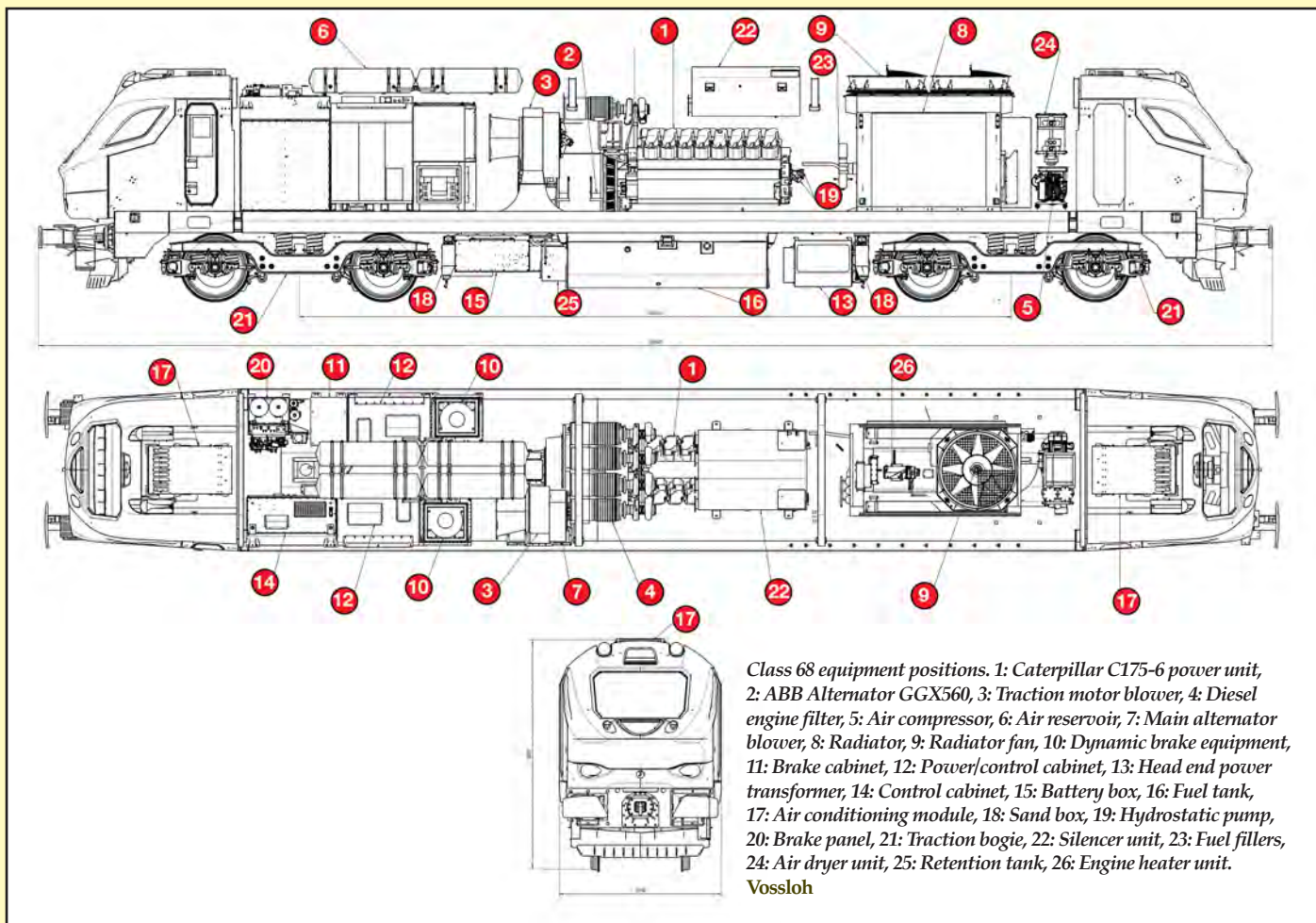
Above: After arriving in the UK via Southampton Docks on 18 January 2014, No. 68002 was taken by road to Crewe. After inspection and testing, the loco was displayed to the UK railway media on 11 March 2014. Here the loco poses outside the front of the shed in company with DRS Class 47 No. 47828 which was rather grubby after working 2013 season RHTT services. CJM



Class:	68
Number range:	68001-68034
Built by:	Vossloh Espania, Valencia, Spain
Classification:	UK-Light
Years introduced:	2014-2017
Wheel arrangement:	Bo-Bo
Maximum speed:	100mph (160km/h)
Length:	67ft 3in (20.50m)
Height:	12ft 6½in (3.82m)
Width:	8ft 10in (2.69m)
Weight:	85 tonnes
Wheelbase:	48ft 10in (14.90m)
Bogie wheelbase:	9ft 3in (2.80m)
Bogie pivot centres:	38ft 8in (11.83m)
Wheel diameter (new):	43¼in (1,100mm)
Min curve negotiable:	4 chains (80.46m)
Engine type:	Caterpillar C175-16 ACERTTM
Engine output:	3,755hp (2,800kW) at 1,740rpm
Max tractive effort:	71,260lb (317kN)
Continuous tractive effort:	56,200lb (250kN)
Cylinder bore:	6.9in (175mm)
Cylinder stroke:	8.7in (220mm)
Transmission:	Electric
Traction alternator:	ABB asynchronous WGX560
Traction package:	ABB Boardline CC1500D, feeding 4 x 4FRA6063 traction motors
No. of traction motors:	4
Brake type:	Air Disc, EP, dynamic regen
Brake force:	73 tonnes
Bogie type:	Vossloh Fabricated
Route availability:	7
Axle load:	21.4 tonnes per axle
Heating type:	Electric - 500kW, Index - 96
Multiple coupling:	Within class and Class 88
Fuel tank capacity:	1,100gal (5,000lit)
Lub oil capacity:	117gal (530lit)
Water capacity:	67gal (304lit)
Sanding equipment:	Pneumatic

Technical Description

Left Middle and Left Lower: After completion, No. 68001, together with Eurolocomotive prototype No. 92 80 1284 001-5 were transferred to the Velim test centre at Cerhenice, near Poděbrady in the Czech Republic. This is one of the main testing locations for rolling stock, and has been a fully accredited European test centre since March 1995. The centre is owned by the Railway Research Institute VUZ, Výzkumný ústav železniční, a subsidiary of Czech national railway operator, České dráhy. In these views, No. 68001 painted in white livery with Vossloh branding is seen with Eurolocomotive No. 1284 001 on 11 February 2014, powering a loaded coal hopper train during performance testing. The size difference of the Euro and UK locos is noticeable. Both: Nark Barber



Left: One of the first times a Class 68 was put in the public eye was at the Innotrans event held at the Messe exhibition centre in Berlin between 23-27 September 2014, when the pioneer of the fleet was placed on display as part of a massive Vossloh stand. The loco attracted huge interest from a world wide audience. However, by this time some 13 locos were already in the UK and indeed working. No. 68001 having been retained in Europe after assembly for testing.

CJM

Below: Locos Nos. 68016 and above were delivered to the UK by way of the Port of Workington, close to the main DRS facility in Cumbria. The locos were shipped in the hold of cargo boats, already mounted on their bogies and craned off and placed on the adjacent rail tracks. After a detailed inspection period, the locos were brake tested, attached to an operational DRS loco and hauled to Carlisle depot for detail commissioning. On 23 May 2017, DRS Class 37/0 No. 37069 hauled all-blue liveried, unbranded Nos. 68031, 68030, 68029 and 68028 past Flimby on the Cumbrian Coast line, as train 0Z85, the 16.00 Workington Docks to Carlisle Kingmoor. Nathan Williamson

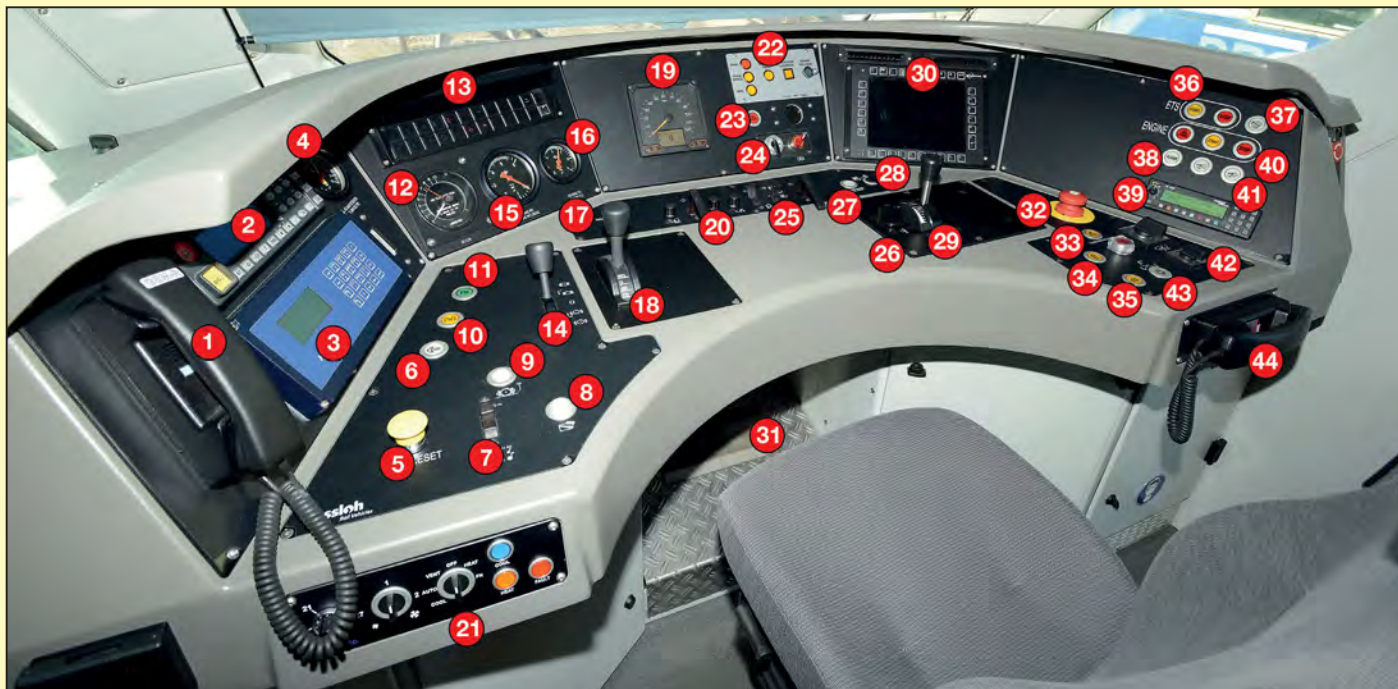




plate by BR Swindon-built Class 42 'Warship' No. D825. The lower image shows the plate Rapid, applied to No. 68004. Again, this is the re-use of an historic plate originally carried by North British-built Class 43 'Warship' No. D838. Both: CJM



Above and Right: In keeping with modern UK loco policy with many operators, names were quickly allocated to the Class 68 design, choosing some rather pleasing traditional names. The names are applied in cast form, using the standard style/ In the upper view is the plate Intrepid, applied to No. 68002, having previously carried, using a different style



Above: 1: Radio telephone hand set, 2: Cab radio, 3: OTMR interface, 4: Main reservoir gauge, 5: AWS reset button, 6: Brake isolation button, 7: Warning horn valve, 8: DSD holdover button, 9: Sanding button, 10: Brake pipe adjuster button, 11: Fast Release button (adjusts air flow), 12: Air flow gauge, 13: Main systems indicator display, 14: Direct air brake (loco), 15: Brake pipe gauge, 16: Brake cylinder gauge, 17: Cab ventilation controls, 18: Train brake valve, 19: Speedometer, 20: Desk/cab illumination, 21: Cab heat/ventilation, 22: TPWS panel, 23: AWS Isolated indicator, 24: Drivers Reminder Appliance (DRA), 25: Headlight control switch, 26: Direction switch, 27: Train length control, 28: Heated windscreen control, 29: Power controller, 30: Loco Management System (driver-machine interface) 31: DSD foot pedal, 32: Emergency brake plunger, 33: Hazard warning buttons, 34: Fire system isolate button, 35: Sanding isolate button, 36: Electric train supply on/off buttons, 37: DSD test button, 38: Alarm warning light, 39: Radio system, 40: Engine start/stop buttons, 41: Parking brake controls, 42: Windscreen washer/wipe controls, 43: Cab switch, 44: Cab communication handset. Cab of No. 68002 is shown in as-delivered condition. CJM

entered into a £15million deal to supply Arriva operated Chiltern Railways with six Class 68s to replace Class 67s on London Marylebone to West Midlands main line services from December 2014. The locos, Nos. 68010 - 68015, were finished in two-tone silver/grey, the house colours of Chiltern Railways, rather than DRS compass colours applied to the rest of the fleet. To enable push-pull working on Chiltern services, using Mk3 stock with DVTs, a push-pull communication system was installed on the dedicated fleet, this included extra jumper connections on the buffer beam.

Soon after delivery of the original locos, Scottish Railways, operated by Abellio approached DRS for a long term hire of two locos, together with a rake of Mk2 stock to operate Fife circle services, this deal was cemented by the repainting of two locos Nos. 68006 and 68007 in Scottish Railways

livery.

In 2017, when it was announced that First TransPennine Express (TPE) was ordering a fleet of Mk 5 loco-hauled stock to operate push pull on TransPennine services, it emerged that DRS had struck a deal to supply Class 68s for these duties with locos Nos. 68019-68032 modified for this purpose. They were repainted in full TransPennine Express colours without a yellow warning end. This service was due to commence in late 2018, but was deferred until 2019 due to issues with the Mk5 stock.

For type test approval and validation of the Mk5 stock, TPE Class 68s Nos. 68019 and 68021 visited the Velim test track in the Czech Republic in late 2017 early 2018.

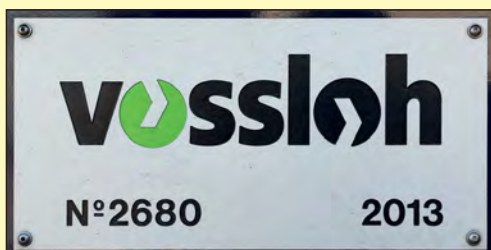
In addition to the dedicated flows, the Class 68s can be found at the head of normal flask traffic. intermodal services, engineers trains and charter

passenger duties, as well as 'stand-in' passenger services operating on Northern Rail and until 2018 on Greater Anglia.

In November 2018, further development of the Stadler bi-mode loco design was announced, when UK-based Rail Operations Group (ROG) through a funding/lease deal with Beacon Rail ordered 10 tri-mode Class 93 locomotives.

Based on the Class 88 design, the locos will offer 5,438hp under electric conditions, 1,800hp under diesel operation and round a 1,000hp from two on-board Lithium Titanate Oxide (LTO) battery packs. Stadler have said the design will weigh 97 tonnes and have a top speed of 110mph.

The 10 ROG locos will replace much of their existing power and follow-on orders of up to 50 locos is expected. The first ROG loco No. 93001 to be named Mercury is due around August 2020. Conveniently in time for Innotrains 2020! ■



Left and Right: Brushed aluminium builders plates are attached to the lower body below the left drivers cab side window. These are etched plates showing the builder - Vossloh (68001-68025) and Stadler (68026-68034), with a works number and year of build. On Stadler plates the assembly plant Valencia is added below the company name. The plates from Nos. 68002 and 68031 are shown. Both: CJM





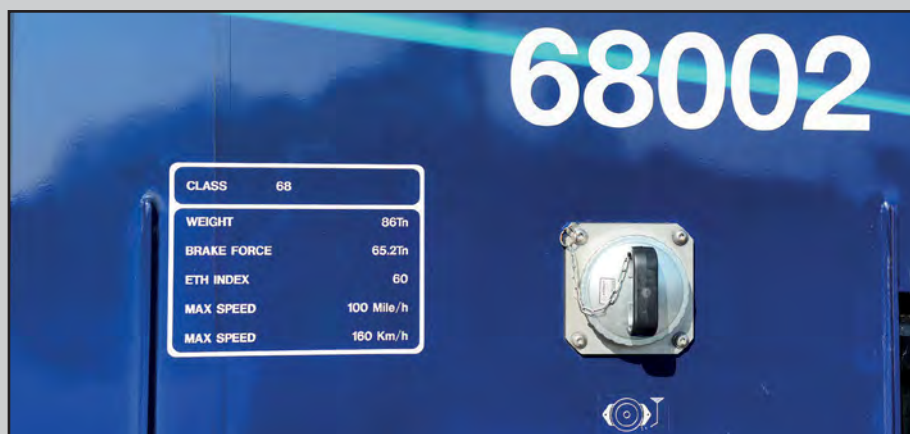
Class 68 Walkaround



Left and Below: Class 68 front end equipment.
 1: High-level marker light, 2: Warning horns,
 3: AAR style multiple control jumper sockets
 (cables stowed on bulkhead in equipment bay)
 [Illustrated below], 4: Windscreen wiper,
 5: Combined head, marker and tail light (using
 LED technology), 6: Lamp bracket, 7: Main
 reservoir pipe (yellow), 8: Air brake pipe (red),
 9: Coupling hook and shackle, 10: Head End Power
 (HEP) or Electric Train Supply (ETH) socket,
 11: Head End Power (HEP) or Electric Train Supply
 (ETH) jumper cable, 12: Adjustable height obstacle
 deflector plate. Of special note is the Vossloh
 company symbol in the middle of the lower
 front end panel to the left of the running number.
 Following the take over of Vossloh by Stadler, this
 was omitted from locos 68026-68034. Both: CJM



Right: Cab side detail, showing Group Standard
 'Data Panel', based on the old BR design, but
 now shows a limited amount of information and
 interestingly shows the maximum speed in both
 imperial and metric measurements. To the right of
 the data panel is the sand box filler port, with its
 UIC international symbol below. CJM



Left: Close up of Vossloh fabricated bogie, clearly
 showing the disk brake fitted wheel sets, main coil
 springs either side of the bogie centre line. The sand
 jets are aimed at the leading wheel/rail interface,
 depending on direction of travel. The cab footstep
 is seen attached to the bogie. The white downward
 arrow on the body above the right wheelset points
 to the No. 1 wheel, P12 indicates the wheel profile.
 On the far left, the inner sandbox can be seen with a
 fire plunger to its right. CJM



Above and Inset: The two bodysides of the Class 68 are slightly different. On each side at the No. 2 or radiator end is a large two panel grille, while to the rear of the bogie at the No. 1 end are two full height and one short grille panel. The grille design on the Vossloh and Stadler locos being very slightly different. In the main image above No. 68001 is seen with its No. 1 end on the left, while the inset image shows a later Stadler loco No. 68030 with its No. 1 end on the right, showing the later style grille covers.

Kim Fullbrook / Nathan Williamson

Right: Left cab side body panel detail, showing the position of the builders plate on the lower framework. This image shows in detail the colour blending of the livery, the arrangement of the buffer mounting onto the frame, positioning of the grab handles and foot holds. It also shows how the separate body panels forming the outer cab were positioned, with the gaps in-filled with rubber mastic. On the lower front panel, the budget locked door, covers the screen wash filler port. CJM



Class 68 Liveries

As delivered

68001-68009	DRS Compass
68010-68015	Chiltern Railways
68016-68025	DRS Compass
68026-68032	DRS Oxford Blue
68033-68034	DRS Compass

Modified

68006-68007	Scottish Railways
68019-68032	TransPennine Express



On Engineers Workings



Above: DRS operate a number of infrastructure contracts for Network Rail. On 27 March 2017, No. 68004 Rapid, pilots Class 37 No. 37419 Carl Haviland 1954-2012 through Hest Bank with a Carlisle to Crewe loaded ballast train.

Cameron Walker



Left: Class 68 No. 68024 Centaur, pilots Class 37 No. 37688 through Bardrill, between Blackford and Gleneagles on 6 June 2016 with a 10.00 Mossend to Fodderty, on the Kyle of Lochalsh line, ballast. The '68' took the train to Inverness, from where Class 37s took over for working on the Kyle line. No. 68024 later returned the train to Mossend.

Ian Lothian

Painted in Abellio Scotrail livery as part of the contract to supply two locos for Fife Circle passengers services in Scotland. No. 68007 Valiant is seen near Clay Mills Junction, Burton-on-Trent on 10 March 2016, powering Network Rail service 6U77, the 13.42 Mountsorrel to Crewe Basford Hall Sidings, formed of two five-vehicle rakes of Network Rail MRA side tipping ballast wagons.

*Cover Pulling
CIM*





Above: Running via the picturesque Settle and Carlisle line, standard Direct Rail Services 'compass' liveried No. 68008 Avenger passes Helwithh Bridge to the south of Horton-in-Ribblesdale on 14 April 2015 powering train 6K05, the 12.46 Carlisle to Crewe Basford Hall infrastructure train, loaded with ballast. The name Avenger is another re-use of an old 'Warship' diesel-hydraulic name, once applied to Swindon-built Class 42 No. D804. **Keith Dungate**

Below: With its radiator end nearest the camera, No. 68024 Centaur, the penultimate Vossloh-built loco, passes Allandale between Greenhill Lower Junction and Cumbernauld on 8 June 2016 with a rake of empty autoballasters. The Network Rail train had been used overnight at Garve on the Kyle of Lochalsh line with a pair of Class 37s which took the empties as far as Inverness, from where the '68' took over, running as the 04.00 Garve to Mossend via Inverness. **Ian Lothian**





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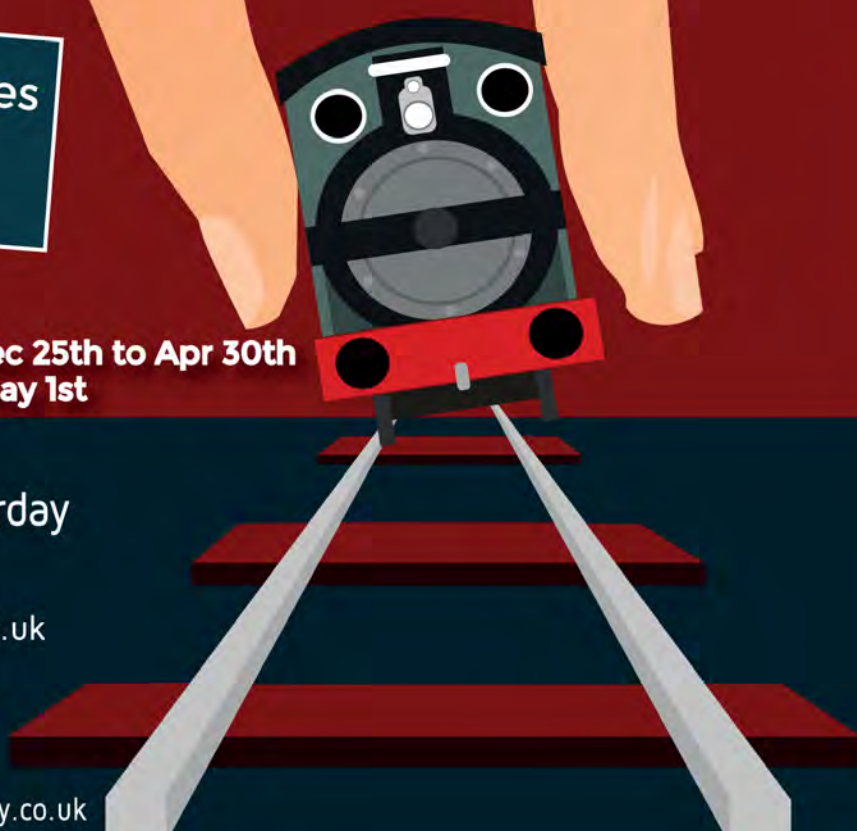
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Above: Soon after the Class 68s were introduced a contract was raised between DRS and Chiltern Railways (owned by Arriva) to supply Class 68s to replace Class 67s used on loco-hauled services between London Marylebone, Birmingham and the West Midlands. Six locos (Nos. 68010-68015) being delivered in Chiltern silver/grey colours and modified for push-pull operation with Mk3 DVT stock. Occasionally locos escape from their captive route and can be found on general DRS duties. On 9 April 2015, No. 68011 is seen passing near Chellaston on the freight only Stenson Junction to Sheet Stores Junction line with a Bescot to Toton engineers train formed of new sleepers.
Jamie Squibbs



Right Middle: Compass-liveried No. 68003 Astute piloting Class 66/3 No. 66304 (dead in tow), lead the 13.14 Inverness to Mossend ballast train on 15 July 2015. The train was running in the path of the 4D47 Inverness to Mossend Intermodal, and is seen passing Powiswood, between Plean and Larbert.
Ian Lothian



Right Below: With its No. 1 end leading, No. 68022 Resolution passes Larbert on 8 June 2016 with the 10.32 Mossend to Achmasheen ballast train formed of Railtrack-liveried hoppers. No. 68022 worked the train as far as Inverness, after which it was 'top and tailed' by a pair of Class 37s to its worksite and back to Inverness, where No. 68022 took over, returning the empty hoppers back to Mossend.
Ian Lothian



Scottish Railways loco-hauled



Above: A shortage of multiple unit stock in Scotland saw the latest franchise holder, Abellio, deploy two rakes of Mk2 loco-hauled vehicles on two Fife circle trains in both the morning and evening peak periods from the commencement of their franchise on 1 April 2015. To provide traction, DRS provided two Class 68s, with Nos. 68006 and 68007 re-liveried in Abellio Scottish Railways colours. However, due to maintenance commitments other Class 68s are frequently used. The hire contract is set to end when a full compliment of Class 385s are in service and fleet cascades are complete. On 2 June 2016, No. 68019 Brutus powers train 2G02, the 07.44 Glenrothes with Thornton to Edinburgh off the Forth Bridge at Dalmeny. Ian Lothian



Left Middle: With one of the ScotRail-liveried pair not available for use, DRS supply a standard liveried example. On 5 July 2017, No. 68004 Rapid hurries through the then recently opened Edinburgh Gateway station with train 2G13, the 17.08 Edinburgh Waverley to Glenrothes with Thornton. CJM

Left Lower: DRS Compass liveried No. 68020 Reliance approaches Polmont station on 19 April 2016 and passes below the newly erected electrification masts for the Edinburgh-Glasgow electrification project, while working train 5G13 the 14.44 Motherwell to Edinburgh Waverley empty stock to form an evening Fife Circle working. When photographed, it was running 63 minutes late resulting in the service it was booked to work being cancelled. Jim Binnie/dieselimagegallery.com

Right: Probably the most famous railway landmark in the world - The Forth Railway Bridge, sees regular Class 68 operations, with the two loco hauled Fife Circle services in each direction, plus the associated empty stock moves. Standard liveried No. 68002 Intrepid pulls into North Queensferry station on 27 July 2015 with the 17.20 Edinburgh Waverley to Cardenden. **CJM**



Below: Passing through Edinburgh Princes Street Gardens and heading towards Edinburgh Waverley from Edinburgh Haymarket, Scottish Railways liveried No. 68007 Valiant, leads train 2K18, the 07.35 commuter service from Cardenden on 28 July 2015. **CJM**





Above: The section of line between Edinburgh Waverley and Edinburgh Haymarket, which runs through Edinburgh Princes Street Gardens, is a four track section, to cope with the high level of both main line and local services. The walls of the gardens and footbridges linking the gardens with the side of Edinburgh Castle, provide some excellent views of the railway. In full ScotRail (Scottish Railways) Saltire blue and white livery, No. 68006 Daring heads towards Edinburgh Haymarket on 1 April 2015 with train 2G13, the 17.08 Edinburgh Waverley to Glenrothes with Thornton. **Antony Christie**

Below: Scotrail liveried No. 68007 Valiant with a matching rake of Mk2 stock, also owned by Direct Rail Services, form train 5G13 the 14.53 Motherwell to Edinburgh Waverley empty stock move, seen near Breich, on 17 April 2015. The train will form an evening Fife circle working, during the day, the locos and Mk2s are stabled and maintained at Motherwell depot. The stock move passes Class 156 No. 156504, forming train 2Y45 the 14.27 Edinburgh Waverley to Glasgow Central. **Jim Binnie/dieselimagegallery.com**





Above: After a slight fall of snow on the higher elevations on 15 February 2016, ScotRail-liveried No. 68006 Daring passes Greenfoot, between Cumbernauld and Coatbridge with train 5G02, the 09.03 Edinburgh Waverley to Motherwell depot empty stock move. The train arrived in the Capital with the second of that mornings Fife loco hauled workings. **Ian Lothian**



Right Middle: Pristine No. 68006 Daring is recorded passing Greenhill Lower Junction on 12 May 2016 with empty stock from Edinburgh Waverley to Motherwell Depot. The train had previously operated empty from Motherwell to Edinburgh Waverley to form one of the evenings loco hauled rush hour services to Fife. However, a door locking fault was found and the passenger service was cancelled, with the train returning to Motherwell for repairs. **Ian Lothian**



Right Lower: For the haulage enthusiasts and photographers the introduction of the DRS loco hauled services added something to the otherwise multiple unit ScotRail world. On 28 July 2015, Saltire-liveried No. 68007 Valiant waits for time at the Edinburgh Haymarket stop with train 2G13, the 17.08 Edinburgh Waverley to Glenrothers with Thornton. A Class 158 is seen on the left with a train bound for Edinburgh Waverley. **CJM**



*The Forth Railway Bridge, or actually The Forth Bridge as its still officially titled, is a massive cantilever structure spanning the Firth of Forth. It was designed by Sir John Fowler and Sir Benjamin Baker and constructed between 1882 and 1889, being officially opened in spring 1890. Its total length is 8,094 feet (2,467m). Today, the structure is a Unesco World Heritage site and a Grade 1 listed structure in the UK. It sees around 200 train movements every 24 hours. On 1 August 2016, No. 68007 Valiant pulls off the Forth Bridge at Dalmeny, with train 2G02, the 07.44 Glenrothes with Thornton to Edinburgh Waverley. **Ian Lothian***





Unit 'vice' in East Anglia



Above: A shortage of suitable diesel multiple units in Anglia based at Norwich, has seen Direct Rail Services provide loco and stock 'stand-in' for a prolonged period, this included extra cover while a Class 170 received accident damage repairs. This should all change in 2019-2020 following the introduction of new Stadler 'Flirt' bi-mode stock. On 28 August 2017, Stadler-built Class 68 No. 68028 painted in branded mid-blue livery leads three blue and grey-liveried Mk2s, with DRS 'compass' liveried No. 68005 Defiant on the rear, forming train 2J78 the 14.05 Norwich to Lowestoft. The train is seen passing adjacent to the 'New Cut' canal at Haddiscoe. The leading loco is now one of the batch repainted for TransPennine Express Mk5 operation and has been named Lord President. **Jamie Squibbs**



Left Middle: Seen in the platform at Great Yarmouth on 5 June 2017, the 17.17 departure for Norwich is formed of three ex Anglia-liveried Mk2s, 'top and tailed' by Class 68s Nos. 68003 Astute and 68022 Resolution. **Antony Christie**

Left Lower: With a train formed of three ex Anglia Mk2s, DRS Class 68s Nos. 68019 Brutus and 68016 Fearless, 'top and tail' the DMU stand-in service forming train 2J70, the 10.05 Norwich to Lowestoft on 20 August 2016. These trains were operated in the 'top and tail' mode as no or limited run-round facilities existed on the Anglia branches. During the period these trains were loco hauled, dozens of enthusiasts flocked to the area to experience and photograph 'loco-hauled' action. **Jamie Squibbs**



Above: Dominated by the wonderful 1884-built, Great Eastern Railway, Yarmouth Vaux (Vauxhall) signalbox, which at the height of mechanical signalling contained 63 levers, but today has been somewhat 'downgraded', an afternoon departure for Norwich departs the station. Power for the three blue and grey-liveried Mk2s is provided by Nos. 68005 Defiant on the front and No. 68028 in mid-blue livery on the rear. **Keith Fender**

Right: Posing under the station lights at Great Yarmouth on 13 March 2017, DRS No. 68003 Astute sits at the head of three blue and grey Mk2s awaiting departure with the 18.47 service to Norwich. **Nathan Williamson**



Below: With the town of Great Yarmouth in the background, No. 68016 Fearless passes Stracey Arms with Anglia-liveried Mk2s, forming the 17.17 Great Yarmouth to Norwich on 17 August 2016. No. 68019 Brutus is on the rear. **Kim Fullbrook**





Above: The country station of Brundell, east of Norwich, is the junction for the Great Yarmouth (via both Berney Arms or Acle) and the Lowestoft lines. On 5 June 2017, Class 68s Nos. 68022 Resolution and 68003 Astute, pull into platform 2 with the 16.38 Norwich to Great Yarmouth service. **Antony Christie**



Left: With upper quadrant semaphore signals prevailing in the area, Class 68 No. 68016 Fearless leads the 18.47 Great Yarmouth to Norwich over the junction at Reedham on 18 August 2016. This was the only regular Class 68 working which traversed the route via Berney Arms. On the rear of the train is sister loco No. 68019 Brutus. **Kim Fullbrook**



Class 68s Selected for Chiltern



Above: Since 2010 Chiltern Railways has operated several longer distance services from London Marylebone to the Midlands formed of Mk3 stock with a DVT. Originally trains were powered by Class 67s, but from December 2014, Class 68s were hired for this operation, with six locos Nos. 68010-68015 set aside for the contract, these were delivered in Chiltern Railways silver/grey colours. On 4 November 2016, No. 68012 is captured passing the village of Kings Sutton, with the 13.10 Marylebone to Birmingham Moor Street. **CJM**

Below: Chiltern Railways added Oxford to its destinations from 25 October 2015. On the first day of service a loco hauled set was used on the 10.35 Marylebone to Oxford powered by No. 68014. The train is seen on the new connection between Bicester South Junction and Bicester Gavray Junction approaching Bicester Village station. The line to Aynho Junction is seen in the background. **David Ive**

On 27 July 2016, No. 68011 pauses at Banbury while leading the 16.15 London Marylebone to Kidderminster service. On the far right, a Chiltern Class 165 set can be seen.

Andrew Royle





Above: Flanked by Chiltern Railways Class 165 'Turbo' sets, Chiltern-liveried Class 68 No. 68011 departs from London Marylebone on 28 May 2015, with the 17.15 departure to Kidderminster, The extra jumper connection on the buffer beam being clearly visible to the left of the electric train heat cable. **Tim Easter**

Below: With Neasden Jubilee and Metropolitan Line London Underground station in the background, Chiltern-liveried No. 68012 passes Neasden South Junction heading towards Wembley Stadium on 8 September 2016, with the 17.15 London Marylebone to Kidderminster. On the left heading towards London is a Class 172 two-car DMU, also operated by Chiltern Railways. **Tim Easter**





Above: On 13 May 2015, No. 68010 slows for its High Wycombe stop while working the 17.50 London Marylebone to Banbury service, this train being formed of the blue-grey liveried Mk3 set which still at the time retained slam doors. The line in the foreground is a bay platform, used by terminating trains. **Kim Fullbrook**

Below: All but one of the Chiltern Mk3 loco-hauled sets was modified several years ago with high-quality sliding plug doors. The one remaining set, originally painted in blue/grey livery was later painted in a revised Chiltern main line livery and frequently referred to as the 'Banbury set'. This coaching set is usually used for one 'up' working each morning from Banbury to Marylebone and then returns empty stock to Banbury for stabling, before returning empty to London for one peak hour evening departure. On 19 June 2017, the set is captured approaching Princes Risborough running empty to London for its evening working. **David Ive**





Above: Traversing the section between Bicester and Oxford at Oddington Crossing, No. 68012 is seen on 10 May 2017, leading the 18.18 London Marylebone to Oxford. David Ive



Left: In normal operating, the Class 68s are formed at the 'country' end of Mk3 formations, with the DVT marshalled at the London end. On 19 June 2017, No. 68012 brings up the rear of the 12.55 Birmingham Moor Street to London Marylebone, passing South Ruislip. CJM

To cover for maintenance, DRS have equipped locos Nos. 68008 and 68009 with the Chiltern push-pull system, but these locos retain their DRS 'Compass' livery. Viewed across the fields at Kings Sutton. With the skyline dominated by the church of St Peter and St Paul, No. 68006 Avenger leads the 16.15 London Marylebone to Kidderminster on 19 April 2018. Andrew Royle





Above: Lined up for departure at London Marylebone on 4 June 2015. Nos. 68011 (left) and 68014 (right) lead rakes of plug-door Mk3 stock forming the 17.15 to Kidderminster and 16.47 to Birmingham Moor Street. This picture shows both sides of the loco, and the livery split, with the light silver grey being at the radiator or No. 2 end. It is interesting to note that black running numbers are applied on the light body section and white numbers on the dark livery. **Antony Christie**

Below: Passing through the middle road at Princes Risborough with an 'up' service to London Marylebone, the last of the dedicated Chiltern Class 68s No. 68015 brings up the rear of the 15.55 Birmingham Moor Street to London Marylebone on 19 July 2016. This loco gained the Chiltern Railways legend in mid blue on the bodyside on the dark panelling at the No. 1 end. **Antony Christie**





Powering 'Flask' Traffic



Above: The core business of DRS is the movement of flask traffic. On 3 September 2018, Nos. 68004 Rapid and 68002 Intrepid pass Longbridge, powering train 6M63, the 11.58 Bridgwater to Crewe yard. CJM



Left: Nos. 68002 and 68033 head towards Otford Junction on 12 September 2017 with three flask wagons forming the Dungeness to Crewe service, the first day '68s' took over from Class 37s. Howard Lewsey

Below: Chiltern Railways-liveried No. 68011 leads train 6M50, the 15.12 Torness Power Station to Carlisle Kingmoor nuclear flask train, with DRS Compass liveried Class 37/6 No. 37604 on the rear. The train is seen approaching Elvanfoot in South Lanarkshire on 10 May 2016. Jim Binnie/dieselimagegallery.com



*The most picturesque area in which to photograph flask trains is around the Cumbrian Coast, where several trains operate daily. On 5 July 2017, Nos. 68003 Astute and un-named 68033 pass St Bees powering train 6C46, the 19.31 Sellafield to Carlisle. **Cameron Walker***



Right: The final two Class 68s Nos. 68033/034 were funded by DRS and not through Beacon Rail, this pair were finished in standard DRS Compass colours. On 17 May 2018, No. 68033 pilots blue-liveried No. 68030 near Park South with the 17.38 Sellafield to Crewe with four flasks heading to southern destinations. **Cameron Walker**

Below: The furthest west normal flask traffic operates is Bridgwater, currently serving the decommissioning of Hinkley Point power station. The service which usually operates a couple of times each week normally consists of two flask wagons operated by a pair of locos. On 5 May 2016, the return train is seen passing Yatton 'top and tailed' by Chiltern liveried No. 68011 and DRS Class 57 No. 57003. **Antony Christie**



*A stunning photographic location is at Redness point, just to the north of Whitehaven, which offers an excellent vista of trains travelling along the Cumbrian Coast route from Parton. With just one flask wagon as its load, train 6M22 the 12.17 Hunterston to Sellafield heads towards Whitehaven on 4 May 2017 powered by Nos. 68016 Fearless and 68017 Hornet. **Cameron Walker***







Above: On the single line north of Barrow-in-Furness to Park South Junction, the pioneer of the '68' fleet No. 68001 Evolution pilots No. 68027 at Ormsgill on 19 May 2018 with an afternoon Crewe to Sellafield working formed of no less than five flask wagons. Frequently flasks are gathered at Crewe off services from the south and west and 'tripped' as one train to the Sellafield re-processing plant. **Cameron Walker**

Below: People are often surprised to find the short, often only one or two wagon flask trains powered by two locos. This is a requirement that such traffic has built in resilience in case of a locomotive failure, the one thing nobody wants is a failed flask train on the railway. On a stunning Cumbrian evening of 19 May 2018, Nos. 68016 Fearless and 68018 Vigilant pass Lindal-in-Furness near Ulverston with two flask vehicles operating a service from Sellafield to Crewe for onward working to the South West. **Cameron Walker**





Above: Passing over the River Mite, just north of Ravensglass on 25 May 2017, Nos. 68027 and 68002 'top and tail' two flask wagons, as train 6C51, the 12.58 BNFL Sellafield to Heysham. The service is operated in this formation due to a reverse movement at Morecambe. **Nathan Williamson**

Right: The nuclear power station at Dungeness in Kent, located way south almost on the banks of the English Channel and close to the Romney Hythe & Dymchurch Railway gets an infrequent flow of flask traffic. On 6 April 2018, Nos. 68005 Defiant and 68025 Superb pass Charing in charge of the 16.35 Dungeness British Energy to Crewe Coal Sidings. **Brian Stephenson**



Below: The area around Seascale, just south of Sellafield, offers some excellent photography locations, looking out over the Irish Sea Coast. Nos. 68030 and 68033 (both un-named at the time, head south on 12 May 2018 with an evening Sellafield to Crewe working. **Cameron Walker**





Above: Much of the scenic Cumbrian Coast line still uses semaphore signals, which add an extra dimension to photographs. On 28 June 2017, Nos. 68016 Fearless and 68028 are seen in charge of the 19.31 BNFL Sellafield to Carlisle Kingmoor flask train. It is seen as it approaches St Bees, a passing point on the single line section between Sellafield and Whitehaven. **Kim Fullbrook**

Below: The Bridgwater flask terminal, located adjacent to the station on the stub of the former line to Bridgwater Docks has a small secure enclosure, where flasks are trans-shipped from road to rail and vice versa. A heavy duty crane is located inside the enclosure and usually locos are stabled in the yard. On 2 August 2017, Nos 68016 Fearless and 68027 extract the loaded wagons from the enclosure before running around and departing to Crewe via Bristol. **Antony Christie**



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The Tesco & Stobart Liner



Above: A regular flow for the DRS Class 68s is the Stobart Rail/Tesco intermodal service linking Daventry in the Midlands with Mossend in the Glasgow area of Scotland. The clean blue-liveried boxes powered by a pair of DRS-liveried locos is very photogenic. On 25 November 2016, Nos. 68003 Astute double heads with No. 68022 Resolution with train 4S43, the 06.16 Daventry to Mossend, seen crossing the River Clyde at Crawford. **Robin Ralston**

Below: More often than not, the Stobart/Tesco train is powered by a pair of locos. On 1 November 2016 it was the turn of No. 68020 Reliance and 68022 Resolution to operate the train. With both locos facing the same direction with their radiator end leading, the 06.16 Daventry to Mossend is seen in the lush countryside at Beck Houses, south of Tebay. **Cameron Walker**





Above: With snow still remaining on the tops of the fells, Nos. 68002 Intrepid and 68023 Achilles bask in the spring sunlight on 24 March 2017 as they head north at Docker with the 06.16 Daventry to Mossend. **Cameron Walker**

Below: In addition to working the Daventry-Mossend corridor, the Tesco intermodal trains also operate north between Mossend and Inverness. Working solo, DRS Compass liveried No. 68006 Daring passes Bonnybridge near Falkirk on 26 August 2014 with train 4D47, the 13.19 Inverness to Mossend. The loco was just eight weeks old at the time. This loco was later selected as one of the pair to be repainted in ScotRail livery. **Jim Binnie/dieselimagegallery.com**





Above: Culloden Viaduct, also known as Naim Viaduct, is on the Highland Main Line, east of Inverness. Opening in 1898, the Highland Railway, 29 span viaduct crosses the valley of the River Naim. Pulling off the viaduct on 30 September 2014, Chiltern Railways-liveried No. 68014 heads the southbound Tesco train from Inverness to Mossend. **N. Burkin / Colour-rail.com**

Below: First of the build No. 68001 Evolution and 68023 Achilles, pull away from Burton-on-Trent on 14 April 2018, while powering train 4S43, the 06.11 Daventry to Mossend intermodal, formed of 38 containers. The train was diverted from the West Coast main line route via the Birmingham area, Chesterfield, York, and Berwick to reach its destination. **John Tuffs**





Above: Compass-liveried No. 68003 Astute speeds north past Blackford, south of Gleneagles, on 3 July 2015 leading the 12.23 Grangemouth to Aberdeen Craiginches Intermodal. Heading south a ScotRail Class 170 is about to clear the rear of the train. **Ian Lothian**

Far Left: With storm clouds gathering over southern Scotland on 20 February 2017, Compass-liveried Nos. 68023 Achilles and 68025 Superb, pass Ravenstruther near Carstairs powering the northbound Tesco intermodal, the 06.16 Daventry to Mossend. **Robin Ralston**

Below: Another route where Direct Rail Services provide staff and power for a Tesco intermodal service is between Daventry and Wentloog on the outskirts of Cardiff, with one return service operating daily. In what is believed to be the first time a Class 68 operated the 08.20 Daventry to Wentloog, the pioneer of the fleet No. 68001 Evolution, speeds past Northway, Tewkesbury, on 22 May 2017. **John Stretton**





On Network Rail Test Trains



Above: Direct Rail Services held a contract to supply drivers and locomotives to power a limited number of Network Rail test trains, until Colas obtained a pair of Class 67. These services were operated in the 'top and tail' mode. On 1 July 2016, standing in for the HST-based New Measurement Train Class 68 No. 68020 Reliance and 68004 Rapid flank test cars 977868, 5981, 977983 and 6264, as they form the 05.35 Old Oak Common to Paignton via Paddington, Penzance and Teignmouth. The train is seen passing Dawlish CJM

Below: Class 68s Nos. 68017 Hornet and 68004 Rapid are seen standing in for the New Measurement Train (NMT) on 15 February 2016. The four vehicle test formation is recorded by the public foot crossing near Alsager, while operating between Derby and Crewe. Cliff Beeton





Above and Right: On 1 July 2016, Nos. 68004 Rapid and 68020 Reliance power the Network Rail New Measurement Train 'stand-in' set. In the above view, the train operates the 15.46 Paignton to Taunton via Bristol and is seen crossing the harbour at Cockwood. On the right, the formation approaches Teignmouth Dockyard with the 05.35 Old Oak Common to Paignton via Penzance and Teignmouth. This was the first time the '68s' had operated this service. Both: CJM

Below: Class 68s are quite rare on the old L&SWR route to the west between Salisbury and Exeter. However on 30 June 2016, Nos. 68004 and 68020 are seen 'top and tail' of the NMT stand-in formation as it approaches Pinhoe, with a Salisbury to Exeter St Davids track recording service. David Ive





Above: On 30 June 2016, a NR test train, running as 1Q31, the 05.20 Derby RTC to Heaton Depot, powered by 'top and tailed' Nos. 68022 Resolution and 68005 Defiant, passes the mothballed steelworks at Redcar on its way to the seaside terminus of Saltburn. Test Coach Mentor, No. 975091 can be seen at the rear of the formation, having been in use earlier in the journey to check overhead wires on the East Coast Main Line. Andrew Royle



Left: Passing through the Cornish station of Menheniot, Nos. 68004 Rapid and 68020 Reliance power the Network Rail NMT 'stand-in' set on 1 July 2016 operating from Penzance to Paignton via Teignmouth. Bernard Mills

Below: Operating over the West Coast Main Line, one of the core routes for the NMT to test, No. 68021 Tireless and 68005 Defiant with vehicles 9523, 977997, 72631 and 975091 Mentor, with its pantograph raised form the 12.29 Crewe to Derby RTC via Euston, seen passing Old Linslade on 14 September 2016. Andrew Royle





Above: With Trematon Castle, owned by the Duchy of Cornwall on the horizon, Nos. 68004 Rapid and 68020 Reliance head over the nine arch Forder viaduct at Saltash, Cornwall on 1 July 2016 with the Network Rail NMT 'stand-in' set. The train was operating from Penzance to Paignton via Teignmouth. Antony Christie

Right: Led by No. 68016 Fearless, a four-vehicle Network Rail test train passes Harpenden on the Midland Main Line, traversing the up slow line on 29 September 2016. Tim Easter

Below: Running over the down main track of the West Coast Main Line, No. 68017 Hornet and 68004 Rapid lead vehicles 72630 and 99666 (Structure Gauging Train 1, 975091 Mentor and Track Recording Coach 999550 on 15 February 2016. The train was running as the 11.16 Derby RTC to Crewe and is seen at Soulbury, near Leighton Buzzard. Andrew Royle





Cumbrian Coast Passenger



Above: The Northern franchise has experienced a shortage of DMU stock for some time, the answer was to hire in two loco-hauled formations from DRS, one four car powered by a 37 and a three-car set top and tailed by 68s. On 12 May 2018 Nos. 68003 Astute and 68004 Rapid form train 2C33, the 15.31 Barrow to Carlisle past Parton. **Cameron Walker**

Left: With the track and stock of the Ravenglass and Eskdale Railway in the foreground, Class 68 No. 68017 pulls away from Ravenglass station on 13 June 2018 with the 12.08 Carlisle to Barrow-in-Furness. **Nathan Williamson**

Below: The three-car set formed by DRS to operate over the Cumbrian Coast route included one Mk2E Driving Brake Standard Open (DBSO) vehicles, which can operate with blue star fitted locos, thus not possible with Class 68s. On 12 June 2018, the 15.31 Barrow-in-Furness to Carlisle is seen passing Salterbeck between Workington and Harrington. No. 68003 Astute leads the train at the far end, with No. 68017 Hornet, bringing up the rear. **Nathan Williamson**





Above: In superb early morning light, Nos. 68004 and 68003 are seen along the Irish Sea Coast at Nethertown on 7 May 2018 with train 2C32, the 05.15 Carlisle to Preston. This train was cut back to terminate at Barrow from the May 2018 timetable change. **Cameron Walker**



Right: Glowing in the early morning light, '68s' Nos. 68017 Hornet and 68003 Astute pass the village of Coulderton, north of Nethertown on 28 May 2018. The set, including a DBSO is forming train 2C40, the 06.18 Carlisle to Barrow-in-Furness. **Cameron Walker**



Above: After pulling away from St Bees and accelerating towards the curve to take the train adjacent to the Irish Sea, Nos. 68004 Rapid and 68018 Vigilant 'top and tail' an afternoon Carlisle to Barrow-in-Furness service on 3 April 2018. **Cameron Walker**



Charter Train Traction



Above and Below: Since their introduction, the Class 68s have been popular requests to power charter and enthusiasts specials and for a period were the preferred motive power for the Northern Belle luxury land cruise train. On 21 May 2017, the Northern Belle operated a lunch time dining charter from Swindon to Swindon via the picturesque Dawlish Sea Wall. The train operated in the 'top and tail' mode with locos Nos. 68017 Hornet at the country end and No. 68002 Intrepid at the London end. In the view above the train is seen skirting King's walk, Dawlish with the westbound service. At least the sun was shining and the tide in for the customers to enjoy. In the view below, the train is seen soon after emerging from Kennaway Tunnel, Dawlish and skirting Marine Parade, with the return train to Swindon. Both: **CJM**





Above: With the Royal Navy dockyard of Devonport in the background, Compass-liveried No. 68017 Hornet approaches Saltash in Cornwall on 4 June 2016 in charge of the Northern Belle Pullman train. The luxury train was forming the 17.12 Par to Swindon. **Antony Christie**

Right: Living up to its name, No. 68004 Rapid hauls a rainbow-coloured rake of coaches through Heyford on 18 July 2015. It is powering the 05.42 Newport (South Wales) to Carlisle Pathfinder Tours 'The Lakes & Border Explorer' charter. **John Stretton**

Below: DRS provided crew and motive power for the Northern Belle on 8 May 2015, when No. 68008 Avenger powered the 08.17 London King's Cross to Inverness land cruise charter. The train is seen awaiting departure from York. Frequently these land cruise trains which start from London are operated long distances by diesel locos working under the wires. **John Whiteley**





Above: With a superb blue and grey-liveried Mk2 passenger rake, No. 68001 Evolution passes Docker on the WCML on 21 April 2018 with a NENTA charter from Norwich. The train 'The Lakes, Shap and Cumbrian Coast Circular' worked outward 'via' Doncaster, Hebdon Bridge and Preston and returned by way of the Cumbrian Coast. **Cameron Walker**



Left: Retro Railtours operated the 'Retro Canterbury Belle' charter on 9 July 2016, operating as the 05.53 Leeds to Canterbury West. The train, 'top and tailed' by Nos. 68005 and 68018, is seen passing Wandsworth Town on the outward leg. After arrival at Canterbury West the locos and stock formed a return charter to Margate and back. **Antony Christie**

On 24/27 February 2017, Pathfinder Railtours operated a charter for the Six Nations Rugby Supporters from Carmarthen to Edinburgh Waverley, outbound on 24 February and returning on 27 February. The charter set was powered and crewed by DRS, who rostered No. 68004 Rapid and 68024 Centaur for the duty. The return train, formed of a mix of former Anglia and blue and grey-liveried Mk2s and powered by No. 68004, is seen crossing Slateford Viaduct on the outskirts of Edinburgh on 27 February running as train 1Z69, 09.35 Motherwell to Carmarthen via Edinburgh Waverley. **Ian Lothian**





Above: With the former Brush Traction works as a backdrop, now used by many other smaller industries, Class 68 No. 68016 Fearless passes through Loughborough on the northbound main line on 2 September 2018 powering a rake of blue and grey-liveried charter stock as the 15.25 Norwich to Burton Wetmore Sidings. The set was returning to its base after being used on the NENTA 'Settle and Wensleydale' charter the previous day. **Antony Christie**

Below: The outbound train of the image shown on the left, 1Z68, the 07.07 Carmarthen to Edinburgh on 24 February 2017, is seen crossing the River Usk at Newport. Motive power is provided by No. 68024 Centaur, the first six coaches of the train being Mk2s restored to immaculate blue and grey livery. The vehicles however, do not carry the original InterCity legend on the lower bodywork. **Mark V. Pike**





Power for TransPennine Express



Above: Throughout 2018, Direct Rail Services at Crewe were preparing a batch of 14 Class 68s Nos. 68019-68032 to operate for TransPennine Express on push-pull Mk5 stock on the Liverpool/Manchester to Middlesbrough/Scarborough corridor. The passenger service was scheduled to commence in December 2018, but due to issues with the new stock this was deferred to spring 2019. On some occasions TPE-liveried locos were used on other duties. On 30 August 2018, No. 68019 Brutus heads along the Sheet Stores Junction to Stenson Junction freight line, powering the 13.58 Mountsorrel to Crewe Basford Hall, Network Rail ballast train.
John Tuffs

Below: Limited testing and driver training took place with the CAF-built Mk5 stock in autumn/winter 2018. In this view set TPE-01 with Class 68 No. 68020 Reliance on the rear propelling, arrives at Crewe on 10 September 2018 with training/test run 3B03, the 14.24 Manchester International Depot to Bletchley. **Cliff Beeton**





Above: Full TransPennine Express-liveried No. 68025 Superb, passes Lichfield Trent Valley on 25 October 2018 with a complete CAF Mk5 passenger rake forming train 3H02, the 09.29 Bletchley Up & Down Relief Line to Manchester International Depot test train. Although considerable dynamic testing had been carried out on the Velim test track in the Czech Republic, a major test and training operation has been undertaken in the UK. **John Whitehouse**

Below: Un-named Class 68 No. 68032 heads north near Lichfield Trent Valley on 8 January 2019 with train 3H01, the 09.31 Bletchley Relief No. 1 to Manchester International Depot TransPennine Express test and training run. **John Whitehouse**



No.	Name	Builder	Works No.	68025	<i>Superb</i>	Vossloh Valencia	2703
				68026		Stadler Valencia	2944
68019	<i>Brutus</i>	Vossloh Valencia	2697	68027		Stadler Valencia	2945
68020	<i>Reliance</i>	Vossloh Valencia	2698	68028	<i>Lord President (09-18-)</i>	Stadler Valencia	2946
68021	<i>Tireless</i>	Vossloh Valencia	2699	68029		Stadler Valencia	2947
68022	<i>Resolution</i>	Vossloh Valencia	2700	68030	<i>Black Douglas (12/18-)</i>	Stadler Valencia	2948
68023	<i>Achilles</i>	Vossloh Valencia	2701	68031		Stadler Valencia	2949
68024	<i>Centaur</i>	Vossloh Valencia	2702	68032		Stadler Valencia	2950

**TPE Loco
Fact File**

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Above: The first test train of the new CAF Mk5 TransPennine Express coaches that could be seen in daylight working over the Trans Pennine Route took place on Friday 25 January 2019, working from Manchester depot to Scarborough and return. The return train, operating as the 07.56 from Scarborough, is seen passing Ravensthorpe Station behind DRS TPE-liveried Class 68 No. 68028 Lord President. **Derek Holmes**

Below: Detail view of No. 68019 Brutus, showing the livery detail. This batch of FTP-liveried Class 68s are the first locomotives to be authorised to operate without yellow ends. An extra jumper socket has been installed on the buffer beam to the left of the ETS jumper to permit push-pull operation. No. 68019 is seen at Crewe on 2 November 2018. **CJM**





'68s' On Special Duties



Above: To allow training of TransPennine Express staff on Class 68s prior to the delivery of the Mk5 stock, it was agreed in 2017 that the off-lease former Virgin Mk3 stand-in set would be taken over by FTE and used in limited passenger service. To bring the set up to operational standard it was overhauled at Laira depot, Plymouth. Four of the former Virgin Mk3s and an off-lease Anglia buffet car are seen passing Magor in South Wales on 27 November 2017 operating as train 5Z08, 07.47 Crewe to Laira via Hereford. Power is provided by No. 68027 in DRS branded mid-blue livery. **Antony Christie**

Below: One of the most unusual workings in 2018 along the Dawlish Sea Wall was on 16 January, when Chiltern Railways-liveried No. 68011 powered train, 5Z63, the 10.40 Laira depot to Crewe LNW sidings formed of six Mk3 coaches for TPE, Nos. 11007, 10229, 12138, 12122, 11048 and 12011. The train is seen being passed by a Class 143 as it approaches Dawlish station from Kennaway Tunnel. As it turned out, the Mk3 stock never entered regular passenger service, but was used for limited staff training. **CJM**





Above: A never to be repeated image, as these two locos Nos. 68022 Resolution and 68027 are now both in TransPennine Express colours. Taken on 29 November 2017, No. 68022 hauled failed No. 68027 towards Dawlish on a Laira to Crewe Gresty Bridge move. CJM

Right: On 19 May 2016, No. 68025 Superb was loaned to the Severn Valley Railway to take part in their diesel gala. The loco is seen leading the LU liveried 4TC set into Kidderminster. Darren Ford



Below: A very unusual train was captured at Carlisle on 26 September 2016, when Nos. 68005 Defiant and 68019 Brutus hauled DRS flask support coaches Nos. 9419 and 9428, with '68' No. 68001 Evolution on the rear as train 6C42, the 13.38 Sellafield to Carlisle Kingmoor. Nathan Williamson





Above and Left Middle: A very unusual image recorded at ElectroMotive Longport on 27 June 2016. Chiltern Railways-liveried No. 68010 is seen in the yard having its Caterpillar engine lowered into place by a mobile crane. Following two equipment room fires, a modification was introduced which required the engine to be removed. In the view middle left, on 8 March 2017, it was the turn of No. 68024 Centaur to have its engine modification. The loco is seen in the workshop yard with its engine mounted in a cradle on an adjacent well wagon. Both: Cliff Beeton



Left Lower: The application of the striking TransPennine Express livery, without a yellow warning end, commenced at Crewe Gresty Bridge depot in autumn 2017. One of the first locos to be re-liveried was No. 68021 Tireless, which is seen in the depot yard alongside Class 57/3 No. 57308 on 22 October 2017. Cliff Beeton



Above: Powered by all-blue liveried No. 68022 Resolution, a loco dedicated to the TransPennine Express contract and now sporting TPE-livery, is seen with the short lived TransPennine driver training set, using ex-Virgin West Coast Mk3 stock. The train is seen departing from Crewe on 7 May 2018 bound for Preston, No. 68022 is at the rear of the set, with No. 68027 out of view on the front. **Cliff Beeton**

Below: On 8 September 2014, brand new Chiltern Railways-liveried No. 68011 was pushed into normal work and is seen passing Hemel Hempstead on the West Coast Main Line with a Wolverton Works to Norwich Crown Point depot stock move, consisting of two overhauled Greater Anglia Mk3 coaches. The '68' has its No. 2 or radiator end leading. **Tim Easter**





Class 88 - UK Dual

The concept of a dual-power or bi-mode locomotive is nothing new, in the closing years of the Southern Railway before Nationalisation in 1948, a plan was hatched for an electro-diesel design to operate from the 650–750V third rail DC supply of the Southern Region system, with, a medium to low output on board diesel engine and generator group used for shunting and yardwork, where the presence of a live rail would be dangerous.

Initially shelved, the project was raised again and came to fruition in the early 1960s, when a fleet of six type JA electro-diesels were built at Eastleigh Works, these had electrical equipment giving a 1,600hp output, with a 600hp English Electric diesel/generator group. The prototypes were followed by a squadron build of 42 near identical locos from English Electric, classified as JB.

The dual power or bi mode design did not end there, for in 1966–1967 a fleet of 10 former 'booster' electric locomotives of type HA were rebuilt at Crewe Works as high-power electro diesels, identified as type HB or Class 74 under TOPS. This design used English Electric electrical equipment with a 650hp Paxman diesel engine. These were for use on the Bournemouth electrification project, to operate both passenger and freight duties away from the third rail supply.

In more recent years, as engineering advances have been made, the term bi-mode or last mile diesel, have become common railway terms, with the development of smaller high-output diesel engines and more compact electrical systems, it became a reality in the 1980s–1990s

to develop locos which could operate from the overhead power supply (of any type or voltage) for mainline running, while carrying a small on-board diesel generator/ alternator group for movement to and from yards, or perform shunting work. It was also possible to use the diesel feature to clear the line if there was a failure of the electric supply, or the loco had an electrical system fault. This was especially useful in times of engineering work where power supplied might be isolated.

The requirements for this method of operation grew, as more and more mainlines became electrified, this was especially the case in mainland Europe, where frequently depots, marshalling yards and private sidings would not be electrified on cost grounds, but main line train access was required and the cost of providing a diesel pilot could not be justified.

By the late 1990s, most of the European locomotive builders, such as Siemens, Bombardier and Alstom where developing bi-mode locos, often marketed as 'last mile locos'. A number of these were profiled at the two-yearly Innotrans events held in Berlin over several shows.

In the UK, huge benefit could be seen by the long-haul freight operators in using bi-mode motive power, but the development costs, vehicle validation and introductory costs, plus Network Rail access charges, put most companies off following this plan, continuing with the time honoured diesel or electric locomotive operation, seeing diesels running hundreds of miles under the wires.

However, Direct Rail Services decided to

progress the bi-mode path, concurrent with the construction of their Class 68s. Vossloh, soon to become Stadler Rail, were at the time actively developing a bi-mode loco based on their Eurolight design. It quickly emerged that Stadler were able to fit a full electric loco system and a medium output diesel engine/ alternator group, into a Class 68 style body structure, that would fit in the UKs restrictive gauge envelope and axle-loading. Hitherto, this had only been possible in the more liberal European loading space envelope.

With this in mind, Stadler Rail, Beacon Rail Leasing and DRS formulated a design for a UK bi-mode loco, which was later classified 88 under TOPS.

On 12 September 2013 it was announced that DRS, through a funding partnership with Beacon Rail, had ordered 10 UKDual electro-diesel locos. The body structure was virtually the same as the Class 68, except for grille differences on the body sides and a revised roof to carry one single arm pantograph, only suitable for 25kV AC collection. Many common components covered both the Class 68 and 88 design, including the brake system, traction systems, bogie design, control software, front and design and most importantly, the driving cab, which is identical to the Class 68 except for additional switchgear covering the electrical side of the design.

Under electric conditions, the Class 88 has a 4MW rating and uses an ABB traction package. Auxiliary or diesel power is provided by a compact Caterpillar C 27 diesel engine, coupled to an ABB alternator set to deliver 950hp ➡

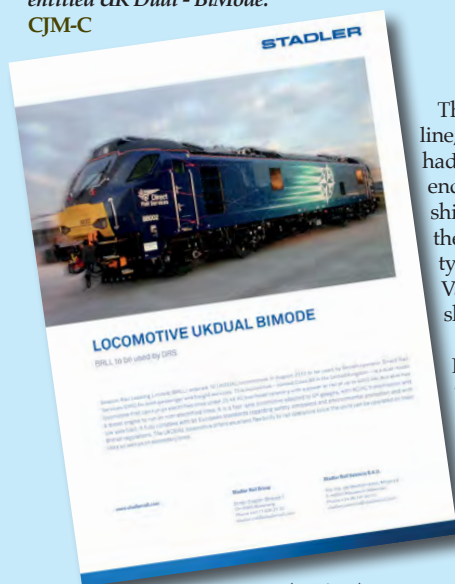
Below: The first time a Class 88 bi-mode or electro-diesel locomotive was seen at close quarters was at Innotrans, held in Berlin in September 2016. With testing of the first two of the build underway, No. 88003 was the selected loco for display. The loco was one of the star attractions of the show and a major feature of the Stadler display. For the duration of Innotrans, the loco carried the badge of its owners Beacon Rail on all four cab sides. The loco is seen from its No. 1 or electric end. **CJM**



Right: After offloading at the Port of Workington, the Class 88s were hauled to DRS Carlisle Kingmoor depot for commissioning, with the exception of No. 88002 which arrived via the Port of Southampton. On 11 May 2017, Nos. 88006, 88009, 88010, 88007, 88005 and 88004 are seen stabled in DRS Kingmoor yard. **Richard Lillie**

Below: At the time of completion of the first Class 88 and before the public debut at Imotrans, Berlin, Stadler produced a glossy brochure on the class, entitled UK Dual - BiMode.

CJM-C



(700kW).

The tractive effort at starting, in either electric or diesel mode being 317kN.

At design stage of the Class 88, it was stipulated as a mixed traffic design, able to haul both freight and passenger trains at up to 100mph (161km/h). The design incorporated head and power (HEP) or electric train supply (ETS). A full regenerative brake system, as well as EP/airbrakes were fitted.

Assembly of the 10 Class 88s was carried out during the transition of the Vossloh/Stadler ownership, and the fleet was deemed as a Stadler product, although construction of the first loco was under Vossloh control. Construction was effected at the Albuixech factory in Valencia, Spain between the summer of 2015 and December 2016.

The first loco off the production line, No. 88001, which at the time had a Vossloh badge on its front end, similar to the Class 68s, was shipped to the Velim test track in the Czech Republic to undergo type test approval, returning to Valencia before de-snagging and shipment to the UK.

The first loco to arrive in England was No. 88002 arriving via Southampton docks on 21 January 2017 and being moved by road to Carlisle. The remaining nine locos arrived via the Port of Workington in two shipments in March 2017.

No. 88003 was transported directly from the assembly plant in Valencia to Berlin, to be the key exhibit of the Stadler display at Inntrans 2016, held at the Messe Centre between 20–24 September 2016.

Commissioning of the Class 88 was undertaken at DRS Carlisle, with the first loco to operate a train on the main line being No. 88002 on 3 April 2017, when it piloted a Class 68 between Carlisle and Crewe. The remaining nine locos progressively entered service over the following seven months.

The Class 88 are to be found operating intermodal, departmental and occasional passenger charter workings under electric conditions, they are frequently to be found powering flask traffic, usually in pairs over the Cumbrian Coast route, where their diesel output is quite adequate for the light weight flask

Class:	88
Number range:	88001-88010
Built by:	Stadler, Valencia, Spain
Classification:	UK-Dual-Mode
Year introduced:	2016-2017
Wheel arrangement:	Bo-Bo
Maximum speed:	100mph (161km/h)
Length:	67ft 3in (20.50m)
Height:	12ft 6½in (3.82m)
Width:	8ft 10in (2.69m)
Weight:	86 tonnes
Wheelbase:	48ft 10in (14.90m)
Bogie wheelbase:	9ft 3in (2.80m)
Bogie pivot centres:	37ft 7in (12.10m)
Wheel diameter (new):	42in (1,067mm)
Min curve negotiable:	4 chains (80.46m)
Power supply:	25kV ac overhead
Traction package:	ABB
Electric output:	5,360hp (4,000kW)
Diesel engine type:	Caterpillar C27 12-cylinder
Engine output:	940hp (708kW)
Starting tractive effort:	71,264lb (317kN)
Continuous tractive effort:	56,200lb (250kN)
Cylinder bore:	5.42in (137.7mm)
Cylinder stroke:	6in (152.4mm)
Traction alternator:	ABB AMXL400
Traction motor type:	ABB 4FRA6063 of 600kW at 4,400rpm
No. of traction motors:	4
Brake type:	Air Disc, EP, dynamic regen
Brake force:	73 tonnes
Bogie type:	Stadler Fabricated
Route availability:	7
Axle load:	21.5 tonnes per axle
Heating type:	Electric - 500kW, index 96
Multiple coupling:	Within class and Class 68 (max 2)
Fuel tank capacity:	395gal (1,800lit)
Sanding equipment:	Pneumatic

Technical Description

trains.

All Class 88s were delivered in a revised, more detailed version of the DRS 'Compass' livery, with a complex 'spiders web' overlay.

Cast nameplates were applied

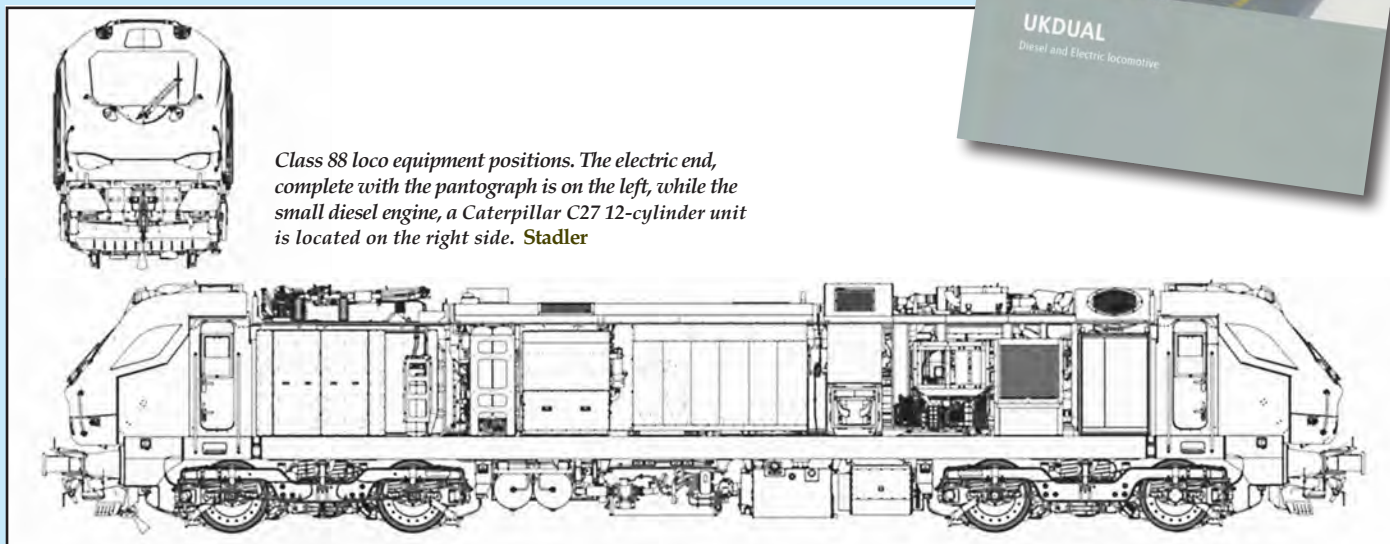
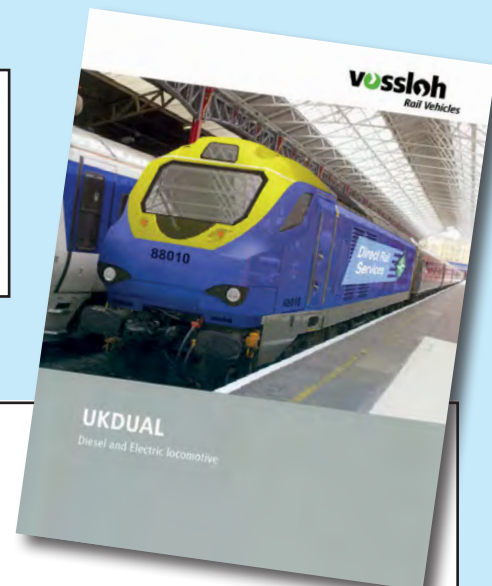
when delivered, in the main, these are a reuse of names previously carried by Class 76 and 77 Woodhead electrics, the exceptions being No. 88001 *Revolution* and No. 88003 *Genesis*. ■

Class 88 Fleet List

Number	Name	Construction Site	Works No.	Date delivered	Point of Delivery	Transport Ship	Notes
88001	<i>Revolution</i> (01/17)	Stadler, Valencia	2851	01/03/17	Workington	<i>MV Eemsflift Nelli</i>	Visited Velim, CZ
88002	<i>Prometheus</i> (01/17)	Stadler, Valencia	2852	21/01/17	Southampton	<i>MV Autostar</i>	
88003	<i>Genesis</i> (03/17)	Stadler, Valencia	2853	01/03/17	Workington	<i>MV Eemsflift Nelli</i>	Visited Inntrans 09/16
88004	<i>Pandora</i> (03/17)	Stadler, Valencia	2854	01/03/17	Workington	<i>MV Eemsflift Nelli</i>	
88005	<i>Minerva</i> (03/17)	Stadler, Valencia	2855	01/03/17	Workington	<i>MV Eemsflift Nelli</i>	
88006	<i>Juno</i> (03/17)	Stadler, Valencia	2856	30/03/17	Workington	<i>MV Atlantic</i>	
88007	<i>Electra</i> (03/17)	Stadler, Valencia	2857	30/03/17	Workington	<i>MV Atlantic</i>	
88008	<i>Ariadne</i> (03/17)	Stadler, Valencia	2858	01/03/17	Workington	<i>MV Eemsflift Nelli</i>	
88009	<i>Diana</i> (03/17)	Stadler, Valencia	2859	30/03/17	Workington	<i>MV Atlantic</i>	
88010	<i>Aurora</i> (03/17)	Stadler, Valencia	2860	30/03/17	Workington	<i>MV Atlantic</i>	



Above and Right: The press drawing of a Class 88 (above) issued on 12 September 2013 when the contract was signed to build the fleet. The early brochure (right) shows a drawing adapted from not a Class 68 but a Class 67, complete with combination coupler and displaying a rather pleasing livery. Both: Vossloh/Stadler



Class 88 loco equipment positions. The electric end, complete with the pantograph is on the left, while the small diesel engine, a Caterpillar C27 12-cylinder unit is located on the right side. **Stadler**

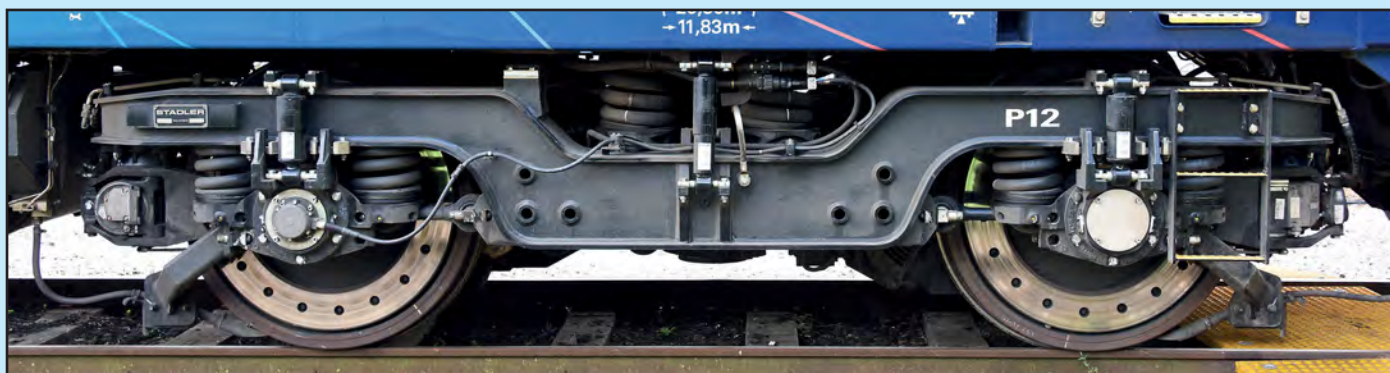


Left: Cab side branding of Class 88, showing the Direct Rail Services logo applied below the cab side window, the five digit TOPS number below and a standard UK data-panel to the right of the sand box filler port, which has the internationally excepted graphic for a sand box filler below in white. **CJM**

Right Upper: Class 88 data panel, showing the legally stipulated information, of class, route availability, weight, speed and electric train heat index. The data panel displayed on No. 88003 at its launch was applied in black, the fleet now carry data panels finished in white. **CJM**

CLASS	88
ROUTE AVAILABILITY	RA7
WEIGHT	85Tn
BRAKE FORCE	73Tn
MAX SPEED	100 mph
MAX SPEED	160Km/h
ETH INDEX	96

Right Lower: Class 88, builders plate. Plate illustrated is from No. 88004. **CJM**



Above: Detail of the Stadler-design fabricated bogie used for the Class 88, clearly showing the disc brake wheelsets, with a P12 profile. The bogie design has four primary coil springs two on each side adjacent to the bogie centre. Sanding is fitted to the outer face of each wheelset. **CJM**



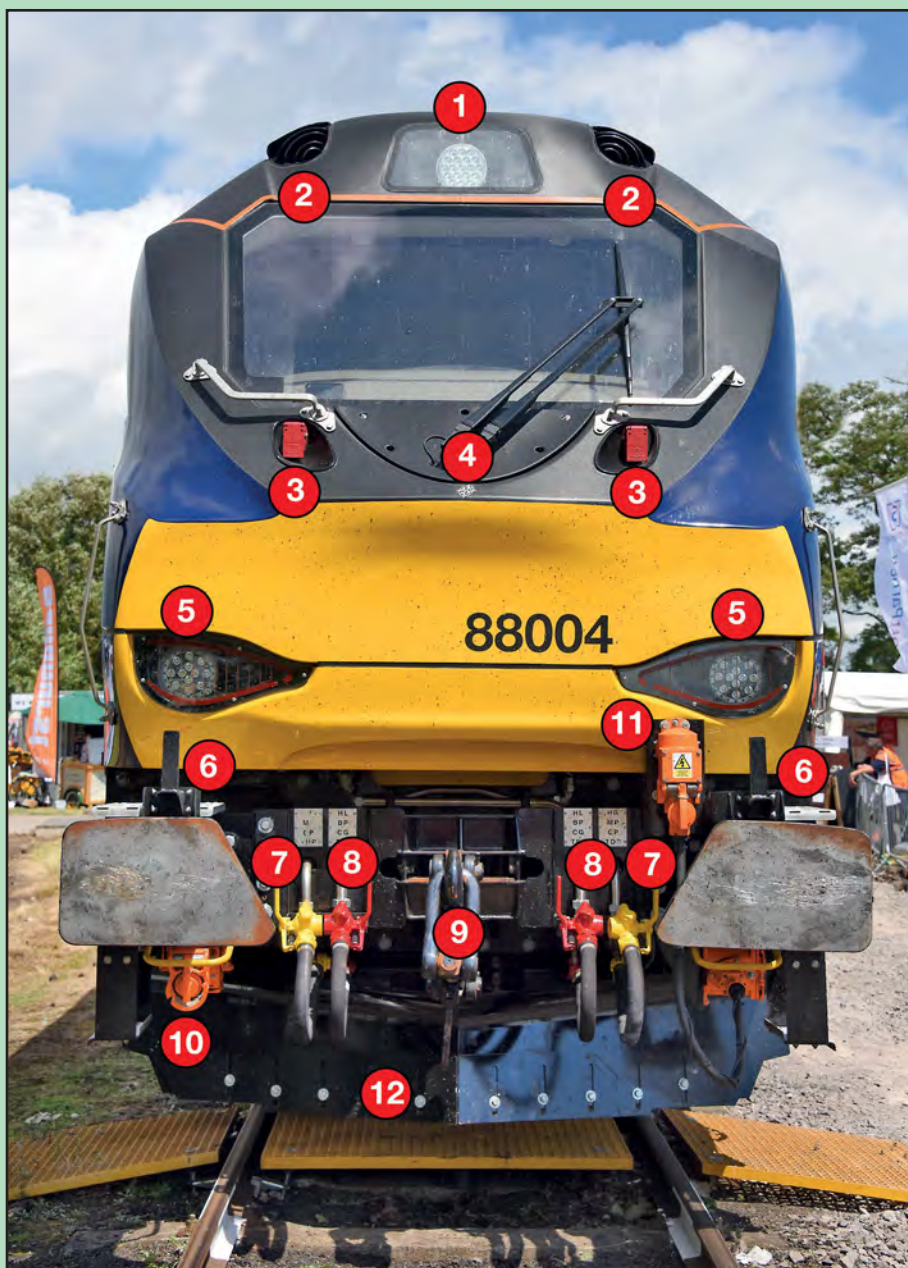
Above: Class 88 driving cab. 1: Radio telephone hand set, 2: Cab radio, 3: OTMR interface, 4: Main reservoir gauge, 5: AWS reset button, 6: Brake isolation button, 7: Warning horn valve, 8: DSD holdover button, 9: Sanding button, 10: Brake pipe adjuster button, 11: Fast Release button (adjusts air flow), 12: Air flow indicator, 13: Main systems indicator display, 14: Direct air brake (loco), 15: Brake pipe gauge, 16: Brake cylinder gauge, 17: Cab ventilation controls, 18: Train brake valve, 19: Speedometer, 20: Desk/cab illumination, 21: Cab heat/ventilation controls, 22: TPWS panel, 23: AWS Isolated indicator, 24: Drivers Reminder Appliance (DRA), 25: Headlight control switch, 26: Direction switch (master switch), 27: Train length control, 28: Heated windscreen control, 29: Power controller, 30: Loco Management System (driver-machine interface), 31: Emergency pantograph down/Engine stop button, 32: Engine start/stop button, 33: Electric Train Supply on/off buttons, 34: DSD test button, 35: APC Isolation, 36: Alarm warning light, 37: Diesel/electric mode switch, 38: Parking brake on/off buttons, 39: Pantograph raise/lower buttons, 40: Emergency brake plunger, 41: Hazard warning light button, 42: Fire system isolate button, 43: Fire delay button, 44: Sanding isolate, 45: Cab switch, 46: Windscreen wash/wipe control, 47: Drivers safety device. Cab of No. 88003 illustrated. **CJM**

Below: Complete with Beacon Rail branding, No. 88003 is seen at Innotrains, Berlin in September 2016 from its No. 2 or diesel end. **CJM**





Class 88 Walkaround



Left: Class 88 front end equipment. 1: High-level marker light, 2: Warning horns, behind air intakes, 3: AAR style multiple control jumper sockets (cables stowed on bulkhead in equipment bay), 4: Windscreen wiper, 5: Combined head, marker and tail light (using LED technology), 6: Lamp bracket, 7: Main reservoir pipe (yellow), 8: Air brake pipe (red), 9: Coupling hook and shackle, 10: Head End Power (HEP) or Electric Train Supply (ETH) socket, 11: Head End Power (HEP) or Electric Train Supply (ETH) jumper cable, 12: Adjustable height obstacle deflector plate. **CJM**



Left: This illustration clearly shows how the Class 68 and 88 are virtually identical in design. The view demonstrates the attachment of the multiple operation jumpers, electrical leads with male/female plug ends that when not in use are stowed inside the loco. For multiple operation both cables need to be connected. **Howard Lewsey**



Above: Class 88 side elevation, showing the No. 1 or electrical end to the right and the diesel end on the left. The two sides are different. A full height ventilation grille is found directly behind the cab door on both sides. With No. 1 end on the right three small grilles are located along the side, while if No. 2 end is on the right, only two small grille panels are located towards the diesel end.
Nathan Williamson

Right and Below: Cast nameplates are applied to each loco, these are fitted mid-height up the body at the No. 1 end. The Direct Rail Services web address is located below the nameplate. The livery applied to the Class 88 is far more complex than that of the Class 68. It is based on the Compass style, but incorporates more detail and a number of intersection 'spiders web' design lines. The cast plate of No. 88002 Prometheus is shown. Both:
CJM





Above: No. 88004 is viewed from its No. 1 end showing the three grille side of the bodywork. The illustration also clearly demonstrates the complex bodyside lining, position of the builders plate and matt finish of the black window surround panel. No. 88004 is seen at the Rail Live 2018 event held at Long Marston on 20 June 2018. **CJM**



Left: Class 88 roof detail, viewed from the No. 1 pantograph end. Above the driving cab is an air conditioning module. The pantograph is directly inward, with the elbow pointing inwards on the loco. Just passed the pantograph a white box on the right side is a camera, which can be used to monitor the pantograph/overhead wire interface. At the far end are the two roof mounted radiator grilles. Loco No. 88005 is illustrated. **Nathan Williamson**



Early Class 88 Workings



Above: No. 88002 Prometheus was delivered to the UK via The Port of Southampton on 21 January 2017 and taken by road to Carlisle for detail commissioning. On 3 April 2017, with certification in place, the loco piloted Class 68 No. 68025 Superb on a loaded test run from Carlisle yard to Crewe. The Class 88s No. 2 end leading. The historic first main line outing was recorded at Oubeck loops near Lancaster. **Cameron Walker**

Below: The pioneer of the '88' fleet arrived in the UK via the Port of Workington on 1 March 2017 and was, together with Nos. 88003, 88004, 88005 and 88008 transferred to Carlisle for commissioning. On 22 May 2017, No. 88001 Revolution is seen on the rear of a short train formed of an IKA twin-wagon and support coach No. 9506 at Carlisle station during a turning move for the Class 88. On the rear of the train is Class 68 No. 68008 Avenger. **Nathan Williamson**





Class 88s On Flask Traffic



Above: Some of the light weight flask trains are placed in the hands of the Class 88s, which can easily operate away from the overhead power using their 940hp diesel engine. With 1,880hp available to the driver, Nos. 88002 Prometheus and 88003 Genesis pass Harrington on 3 April 2018 with two flask wagons from Seaton to Sellafield. **Cameron Walker**



Left: Some very interesting and unusual trains can be seen and recorded in the Sellafield area. On 14 June 2018, train 6X23 the 10.02 Sellafield to Barrow Docks is seen at Barrow-in-Furness powered by Class 88 Mo. 88008 Ariadne with KXA wagon 96905, PEA No. 92856 and Class 68 No. 68033 (still unnamed) on the rear. **Nathan Williamson**

On 12 June 2018, train 6M23, the 12.17 Hunterston to Sellafield, formed of just one flask wagon, is seen passing Salterbeck between Workington and Harrington. Power is provided by Nos. 88010 Aurora and 88002 Prometheus. Both locos are running with their electric end leading. **Nathan Williamson**





Above: One of the more impressive views of the Cumbrian Coast line is that of Eskmeals Viaduct, south of Ravenglass. Evening pictures on a southbound train on a clear day are outstanding. On 9 August 2018, Class 88s Nos. 88004 Pandora and 88002 Prometheus crosses the structure with an evening Sellafield to Crewe working, consisting of two flask wagons. The viaduct, constructed by the Whitehaven and Furness Junction Railway crosses the River Esk. **Cameron Walker**

Below: With the Irish Sea as a backdrop and clear early morning light, Nos. 88006 Juno and 88001 Revolution skirt the coast at Coulderton between St Bees and Nethertown on 7 July 2018 powering two flask wagons en route from Carlisle Kingmoor yard to BNSF Sellafield. The lead loco has No. 2 (diesel) end loading and the second has No. 1 (electric) end leading, so both sides are displayed, showing the grille and body differences. **Cameron Walker**





Modern Locomotives Illustrated - Classes 68 and 88

Class 88s at Work



Above: After entering freight service in April 2017, it was not going to be long until a Class 88 operated a passenger train, especially with DRS providing power for the Northern Belle train. The passenger debut came on 9 May 2017, when No. 88002 Prometheus powered the return leg of a Northern Belle train from Carlisle to London Euston. In perfect conditions, the train is seen passing Hest Bank. Cameron Walker

Below: When any new or rebuilt locomotive enters service, the enthusiast followers are keen to have an example powering a passenger train, so they can ride behind the power. The Class 88s, were no exception, especially as these were of the bi-mode design. To satisfy the demand, the Severn Valley diesel gala in May 2017 managed to secure the use of one loco plus an air braked Mk2 passenger rake. On 18 May 2017, No. 88003 Genesis emerges from Foley Park Tunnel powering the 13.47 Kidderminster to Bridgnorth. Antony Christie





Above: With its electric or No. 1 end leading, No. 88005 Minerva glides through the Lune Gorge on 20 April 2018 powering the daily Carlisle to Crewe Network Rail train, on this occasion formed of a five-vehicle set of side-tipping ballast delivery wagons, carrying the old Railtrack livery, but branded Network Rail. The versatility of these bi-mode locos is fully demonstrated when powering this type of train, having the ability to pull away from non-electrified sidings using its diesel engine and then, while on the move, transfer to electric power for the main journey. Cameron Walker

Below: A prime candidate for electric operation was the DRS powered Daventry-Mossend Stobart/Tesco intermodal, which for some 99% of its journey operated under electric power lines. With both locos, Nos. 88003 Genesis and 88007 Electra having their pantographs raised, the driver of train 4S43, the 06.16 Daventry to Mossend had a full 10,420hp available as he passes Ravenstruther on 27 October 2017. Robin Ralston



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Above: With its colourful train, a mix of blue Stobart/Tesco, and mauve Excel boxes, the Mossend to Daventry is recorded on 13 May 2018 passing Shap Beck. Motive power is provided by No. 88003 Genesis. **Cameron Walker**



Left: The stunning scenery through the Northern Fells of the West Coast route, provided a stunning backdrop to the pleasing body lines of the '88s'. On 25 July 2018, No. 88007 Electra passes Elvanfoot with the Mossend to Daventry service. **Cameron Walker**

Below: Passing over Docker viaduct on the West Coast Main Line north of Oxenholme, the northbound Daventry to Mossend is seen powered by Nos. 88008 Ariadne and 88009 Diana on 8 November 2017. **Cameron Walker**





Above: Running through the picturesque northern section of the Fells in southern Scotland, No. 88005 Minerva heads south on 29 June 2018 with the Mossend to Daventry Tesco/Stobart intermodal. The train is seen passing Wandel in the Clyde Valley, located between Carstairs and Abington. Cameron Walker



Right Middle: During the hot sunny afternoon of 28 May 2018, Class 88 No. 88010 Aurora, pilots DRS Class 66/4 No. 66423 at it approaches Oxenholme Lake District. The duet are powering train 4Z41, the 10.55 Mossend to Daventry intermodal service. With this formation, the Class 66 would be operated 'dead in tow' as no multiple control facility exists between the two classes. Mark V. Pike



Right Lower: To cope with the pre-Christmas demand for perishable goods in the weeks leading up to Christmas 2017, an additional 'Tesco' service operated, running as the 10.22 Mossend to Daventry. On 15 December 2017, No. 88005 Minerva leads the service passed Cleghorn between Carlisle and Carstairs. Robin Ralston



Above: Captured in the transition between fog and clear sunlight on 20 January 2018, after a heavy fall of snow which blanketed much of Scotland, No. 88006 Juno passes Ravenstruther powering train 4S43, the 06.40 Daventry to Mossend, Tesco and Stobart intermodal train. **Robin Ralston**

Right: In dire weather conditions when the photographer should have probably stayed in the warmth of his home, he ventured out on 16 January 2018 in bitter conditions to capture No. 88008 Ariadne battling through Carlisle station in charge of train 4S43, the 06.16 Daventry to Mossend intermodal. **Robin Ralston**

Below: Rapidly approaching the Scotland-England border on 14 October 2018, No. 88004 Pandora passing the village of Springfield, between Quintinshill and Gretna Junction, powering train 4M48, the 14.53 Mossend to Daventry, a well loaded intermodal service. **Robin Ralston**







Above: For those wanting to see Class 88s in action a good starting point is Carlisle station, where on most days three or four class members can usually be seen powering either intermodal or flask traffic. On 30 November 2017, No. 88004 Pandora eases its way through Carlisle station heading an intermodal train from Mossend to Daventry. Refurbishment of the station roof was almost complete at the time, with some scaffolding already dismantled revealing a much improved environment to both passengers and staff. **Peter Marsh**

Below: Passing Hest Bank, north of Lancaster, No. 88005 Minerva heads south on 8 July 2018 powering the Mossend to Daventry intermodal. **Cameron Walker**





The Eurolight Family

The pioneer Vossloh 'Eurolight' No. 92 80 1284 001-5, built to Vossloh works number 2603 in 2010 and displayed at Innotrans, Berlin in September 2010. CJM



The Vossloh Euro (or Stadler Euro from 2015) is a diesel-electric loco built for the European market, available in various designs, including the four-axle Euro 3000, and the six-axle Euro 4000.

At the early 2000s, as open-access freight operation grew in Europe, before complete liberalisation in 2012, the quest for modernised or new motive power emerged, EMD offered their Class 66 range and Vossloh the G2000. Soon, the need of a complete new high-powered diesel loco emerged, especially for cross-border traffic where changes in electrification voltage saw the use of electric traction near impossible.

In the mid-2000s Alstom's Prima loco platform was extended to cover this need, with a development programme operating under Alstom supervision. Soon after, in 2004 the Valencia plant was sold to Vossloh, who furthered the project and commenced production of the Vossloh Euro design.

Under Vossloh, the first new build was the RENFE (Spanish Railways) Class 334 which are Iberian gauge Vossloh Euro locomotives.

From the success of the Euro loco platform,

emerged the 'Eurolight', with a trial/development loco emerging in 2010, from this the UK light or Class 68 was developed.

As traction development progressed, Vossloh looked into the possibility of adapting the Eurolight diesel into a Euro Dual, an electric

version incorporating a diesel engine for 'last mile' operation, basically an electro-diesel. This was successfully achieved and from this work the UK dual, or Class 88 was derived. During the process of development of the Euro Dual, Vossloh was taken over by Stadler. ■



Model of the proposed EuroDual Co-Co loco family, able to operate from 1.5, 3, 15 or 25kV ac or from an onboard 'last mile' diesel. Stadler

Euro Platform Overseas

Euro 3000 (Renfe Class 334) 334001-334028, 2006-08

Euro 3200 (Israel) 1301-1324, 2013-14

Euro 4000 (Spain Class 335) various lease owners / operators
Alpha Trains§ - 335003-038, E5033-36
Cosma 335001-002, Takargo 6001-6007, RailCare 68901-02
Beacon Rail± 312001-006, 4001-42, 335031-032
Israel 1401-15, AFRO (South Africa) 4001-4020,
France ETF E4029-30, VFLI, France E4027-28, 4049-53
Ferrovial Argoman 335031-032

§ With Transfesa, Transita Rail, Continental Rail, Logitren, Ibe Cargo, Medway.

± With CargoNet, Europorte, VFLI

Euro 4001 Prototype

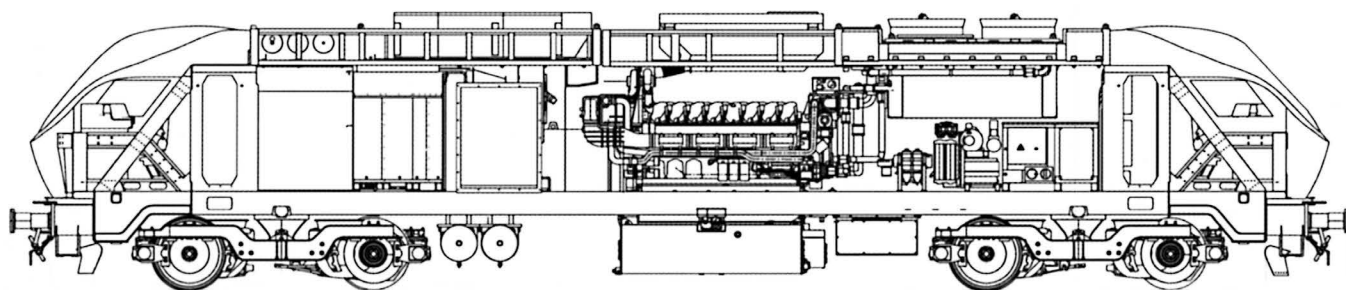
Euro Light Prototype locos 284 001, 284 002

Euro Dual Prototype 92 87 0006 001 France
Production 90 80 2159 001 - 003 HVLE Germany

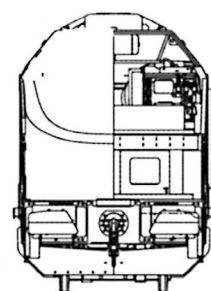
Prasa Dual South Africa Works Nos. 2801-2804



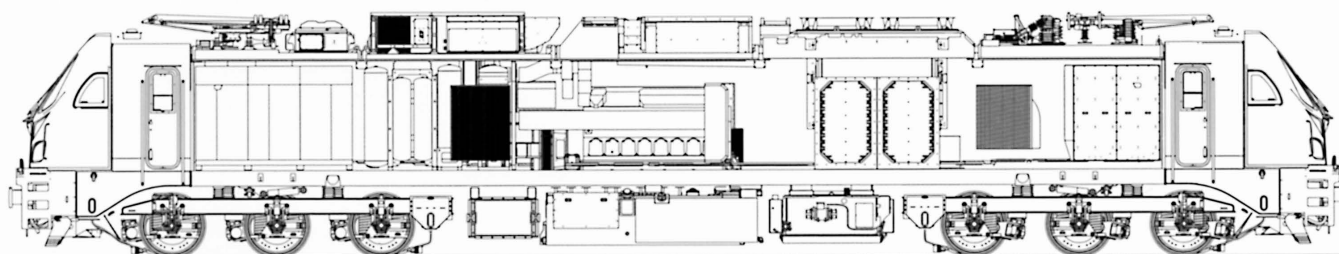
Above: Detail of the futuristic Vossloh/Stadler 'Eurolight' driving cab. Specially designed to meet the needs of multi-nation railways and one which reflects the current needs of driving staff. When the Class 68 and 88 were ordered a refined and modified version of this was adopted, changed to incorporate UK requirements such as AWS, OTMR and TPWS. The cab illustrated is from Vossloh demonstrator No. 92 80 1284 001-5, built to works number 2603 in 2010. **CJM**



Above and Right: Equipment drawing and layout for Eurolight diesel-electric loco, from which the UK Class 68 was devised. This drawing clearly shows the steel frame in the cab area providing the UIC crash worthiness levels. The Caterpillar C175-16 prime mover is located almost central above the fuel tank, while the cooler group is located on the right side, directly inward from the cab transverse walkway. **Vossloh**



Left and Below: The latest product from the Stadler locomotive plant is the massive EuroDual bi-mode loco platform. This uses a Co-Co bogie configuration and has the ability to operate off multi-voltages, incorporate multi-nation signalling systems and give an output of up to 9300hp (7000kW) under electric conditions and 4000hp (3000kW) under diesel power. The top speed envisaged is 100mph (160km/h) using ac traction technology. An option of various Caterpillar power units between 8-16 cylinders could be incorporated. **Stadler**





Above: A number of Vossloh/Stadler main line diesel locos of the Euro platform are operating in Mainland Europe. Takargo No. 6005 is a Euro 4000, built by Vossloh in Spain in 2000 to works number 2351 for Portuguese operator Takargo. It is a Iberian 1668mm gauge loco and authorised to operate in both Portugal and Spain. On 10 June 2015 it is seen at the head of a log train at Porto Campanha station. CJM

Below: A major hub of rail activity in Portugal is at Entroncamento, where adjacent to the busy station is the Portuguese National Railway Museum, housing a large collection of steam locomotives, modern traction locomotives, multiple units and rolling stock. Approaching the station on 11 June 2015 is Class 335 No. 335 002-2 with a southbound liner train to the nearby container terminal. This is a Euro 4000 built in 2008 and operated by Comsa Rail Transport of Spain and authorised for through operation to Portugal. CJM



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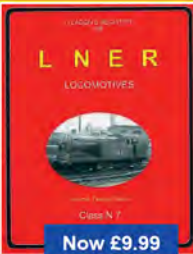
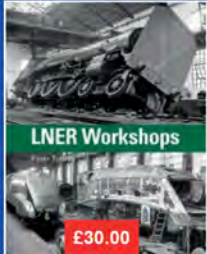
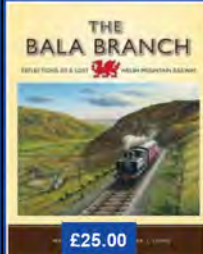
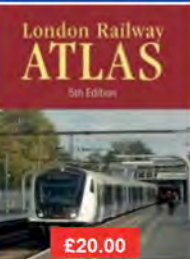
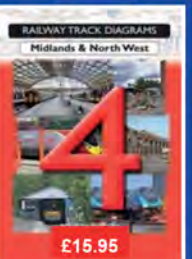
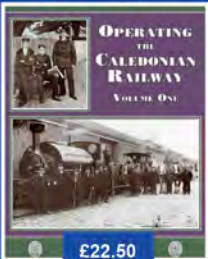
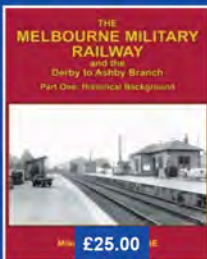
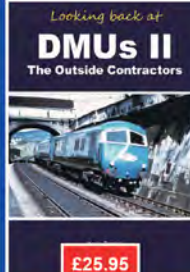
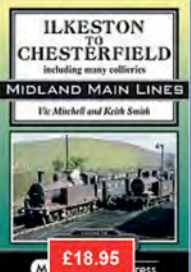
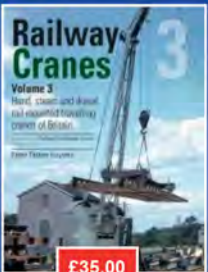
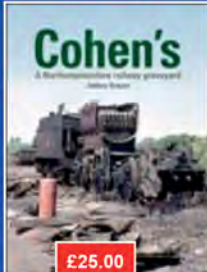
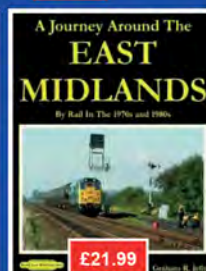
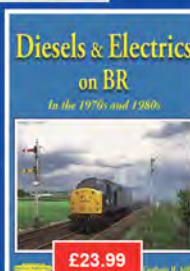
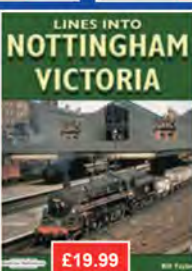
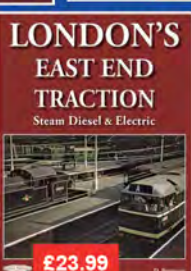
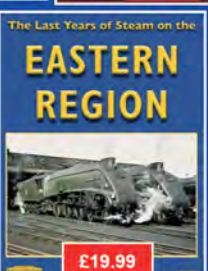
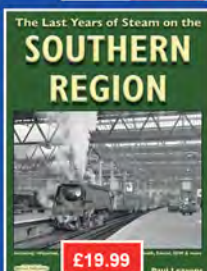
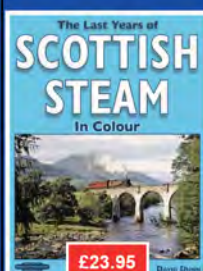
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